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ELECTRICAL WORLD

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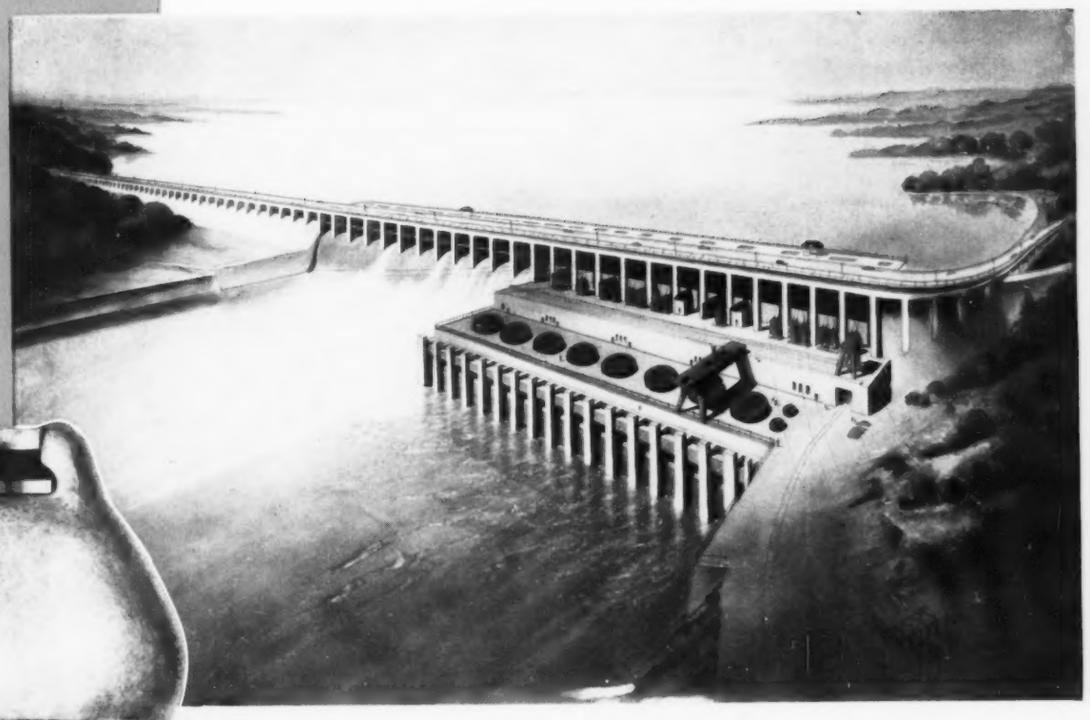

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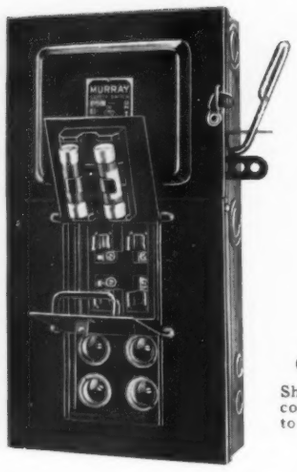

Catalog No. 273
Circuit Doors Open

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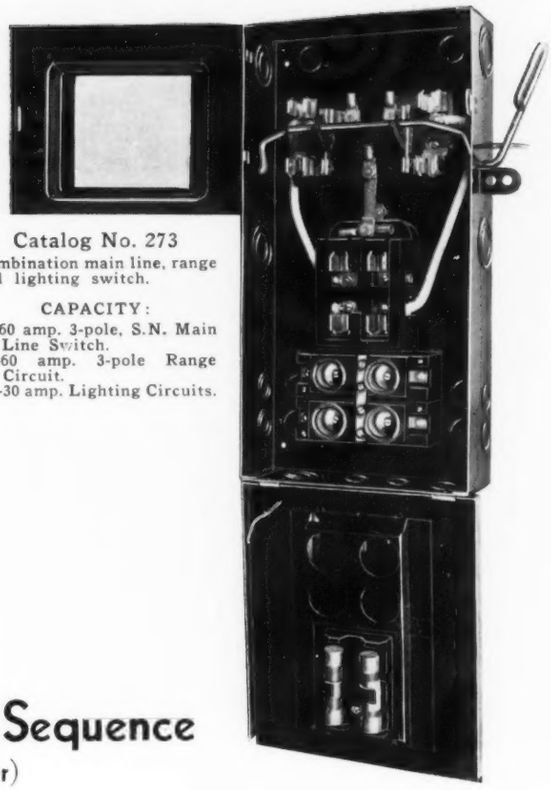

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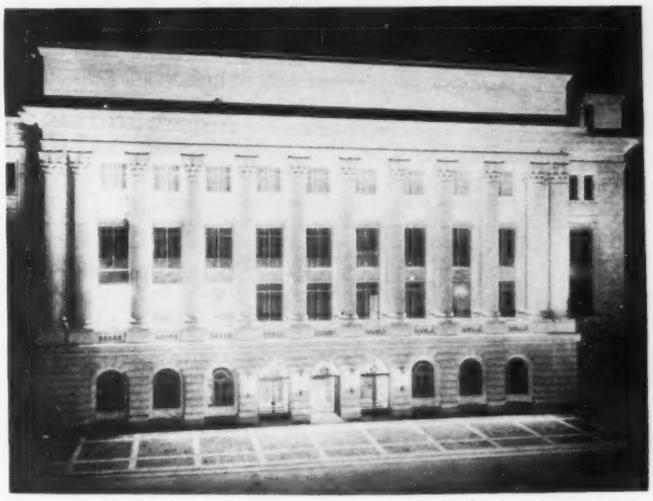

Floodlighting U. S. Dept. of Agriculture Washington, D. C.

JUNE 20, 1931

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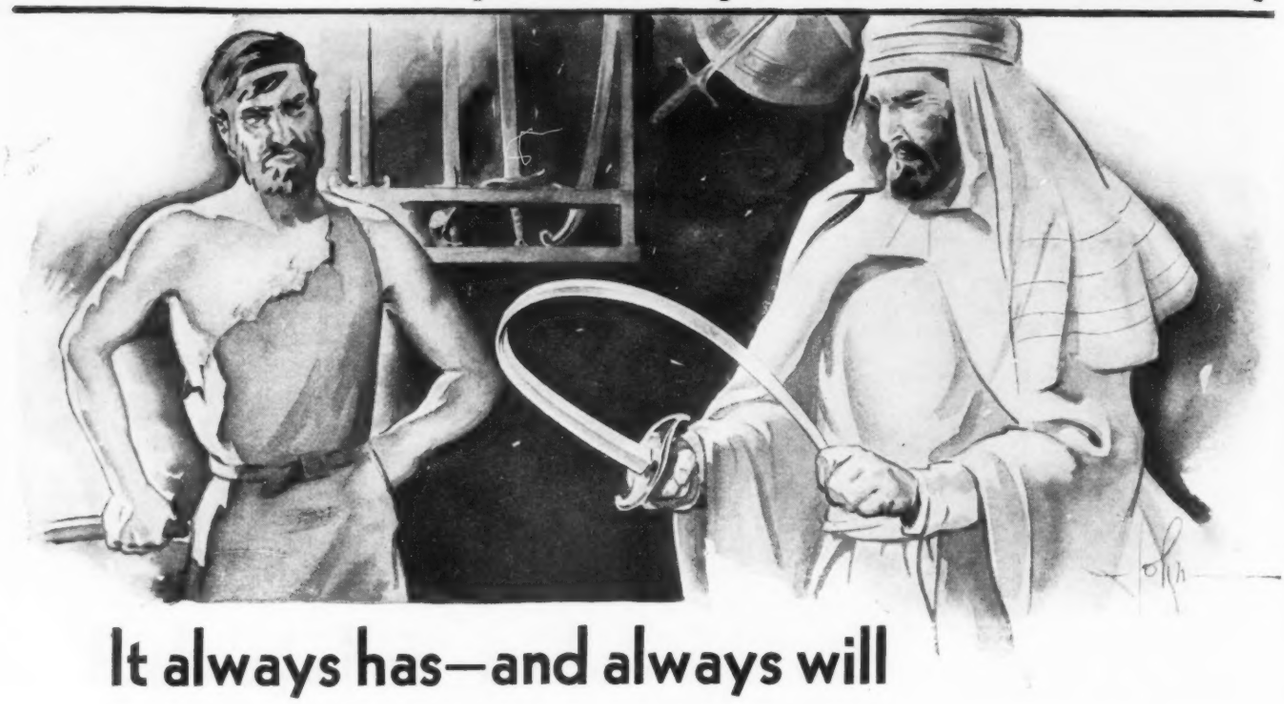
Performance Depends Upon Inbuilt Quality



It always has—and always will

LOOKING backwards, the seasoned operator remembers that the best materials always made the big savings in maintenance and prevented disastrous plant breakdowns. He knows that the engineering millenium of uniform quality is not attained in practice, and that discrimination in selecting material is the only watchdog of service.

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ELECTRICAL WORLD

for the Week Ending

June 20, 1931

Shall we abandon the philosophy and creed of our people for 150 years by turning to a creed foreign to our people? Shall we establish a dole from the federal treasury? Shall we undertake federal ownership and operation of public utilities instead of the rigorous regulation of them to prevent imposition? Shall we protect our people from the lower standards of living of foreign countries? Shall the government, except in temporary national emergencies, enter upon business processes in competition with its citizens? Shall we regiment our people by an extension of the arm of bureaucracy into a multitude of affairs?

The future welfare of our country, so dear to you and to me for ourselves and our children, depends upon the answer given.

HERBERT HOOVER.

Industrial gas an off-peak load?

—**Electrolysis by off-peak power** offers attractive opportunities in the production of industrial gases. Electrolytic cells at the power house, operated under direction of load dispatcher, suggested as a practicable expedient—*p. 1182.*

—**Enameling proves economical** when properly done the electric way. Analysis reveals minimum rejects, low labor cost and low maintenance expense as major factors. Operating cycle proves important—*p. 1168.*

Rural service gains in New England

—**Organized for rural service,** the operating subsidiaries of the New England Power Association have added 3,800 farm customers to their lines in the past two years. Co-operation and organization did it—*p. 1173.*

—**Two utilities to serve bridge** to assure perfect service. George Washington span over the Hudson, one of the longest of suspension bridges, to be served from New York and New Jersey. Airway lighting a feature—*p. 1161.*

Customers aided by merchandising

—**Oregon proves a contention,** long held by utility men, that public interest demands merchandising. Facts and figures marshaled to demonstrate the validity of "maximum usage at minimum rates" idea—*p. 1180.*

—**Washington's consent decree** may be modified in virtually all its essentials if proposal of Public Utilities Commission of the District of Columbia is made effective. Rates, already among the lowest, would go lower—*p. 1160.*

Portland group in Federal Trade quiz

—**Lighting and traffic safety** proved related by analysis of Cleveland's adequately and inadequately lighted streets. Engineer sees 37 per cent of night fatalities as avoidable—*p. 1186.*

—**New and efficient steel mill** electrified according to latest practices. Here 35,000 hp. of electrically operated machinery coordinates production steps. Both a.c. and d.c. used. Continuity of supply assured—*p. 1176.*

Public Utility Men Advocate Expansion of Advertising Programs

PROMINENT executives of public utility organizations extolled the advantages of a liberal advertising policy in addresses made before the Public Utilities Advertising Association, which met at New York this week on Tuesday and Wednesday, with an attendance of 200, its sessions forming part of the annual convention of the Advertising Federation of America.

The first of these speakers was George B. Cortelyou, president Consolidated Gas Company, New York, who asserted that the executives of most utility organizations were agreed more than ever before in the belief that the progress of their companies would depend to a large extent on adherence to sound principles of education and promotion, in the application of which advertising would play a leading and perhaps vital part.

"Within recent years," said Mr. Cortelyou, "the need for public understanding of the utility business has grown to a point where it is at least equal in importance to the technical and economic problems which continue to confront us. Co-operation on the part of the public is as necessary as that within our own ranks, in order to achieve and maintain the highest standards of efficiency and usefulness in the service we render. Advertising, as the liaison officer of the utilities, can do much to create an intelligent and enlightened public opinion based on a sympathetic knowledge of our mutual requirements and aims. Public utility advertising thus has a real opportunity to demonstrate its value both to the organization which employs its facilities and to the community at large."

William H. Hodge of Chicago, vice-president Byllesby Engineering & Management Corporation, defended the utilities against their political detractors. Asserting that the term "power trust" was the publicity slogan of these politicians, he said that there would be no advertising if the political ideas advanced by them were to become dominant.

Irving M. Tuteur of Chicago, president of the Public Utilities Advertising Association, announced that utility companies would be urged to maintain and if possible increase their advertising efforts in the daily newspapers. "The records of advertising expenditures of public utilities show that approximately two-thirds or more of our appropriations are invested in newspaper space and that this percentage is as a whole increasing each year," Mr. Tuteur said. "This condition prevails solely because newspaper advertising has demonstrated its effectiveness, economy and sales value to the utilities."

Other speakers were Owen A. Conner, financial editor Philadelphia *Public Ledger*, and W. A. Bowe of the General Electric Company, Schenectady.

Edwin Gruhl, vice-president North American Company, spoke before the main association on Wednesday on "Minus Costs," or those which yield benefits far in excess of the sacrifices they entail. One such cost, he said, is advertising, the principal factor in lessening cost of distribution.

▼

Utica Rates Readjusted to Fit Company's Figures

ACCEPTING AS CORRECT the Utica Gas & Electric Company's revised figures of revenue (ELECTRICAL WORLD, June 13, page 1089), the New York Public Service Commission on June 17 amended its February order reducing the company's income by $69,220 (in addition to $182,056 previously deducted) so that the amount of the present reduction will be only $38,914, making the total reduction since November, 1929, $251,276. This finding is predicated on insuring the company a 7 per cent return.

▼

UNDER WATER AND OVER LAND

One of the six reels of 25-kv., three-conductor General Electric submarine cable for installation between the Brigantine and Beach Haven substations of the Atlantic City Electric Company, running under many bays and inlets and connected to overhead cable on the small islands between the two towns.

▼

Industrial Electrification as Viewed by A.I.S.E.E.

"SUCH COMPETITION as exists today makes it necessary to electrify older plants and to be constantly on the lookout for new methods and new processes which will effect greater economies in production costs in plants already electrified." This quotation expresses the tone pervading the convention of the Association of Iron and Steel Electrical Engineers at Cleveland on June 15 to 19. It is taken from the report of the electrical developments committee as presented by its chairman, W. H. Burr of the Lukens Steel Company.

This theme was conspicuous in the report and also in many of the convention papers. It was strikingly apparent in the papers on twin-motor drive by R. H. Wright and H. E. Stokes, Westinghouse, and on motor and control equipment for cold-strip mill drives by F. Mohler, General Electric. The former paper described a very significant development in the application of electric power to reversing mills producing large steel shapes—the substitution of individual motors on each roll for the usual single-motor gear drive. A detailed discussion of this development will appear in a future issue of the ELECTRICAL WORLD.

Of great interest is the reference to electrical control in the committee report already quoted. This reference expresses "complete faith in the application of the thyratron type of tube in the broad industrial engineering field to the same amazing extent that the high-vacuum type of tube has dominated the radio communication and broadcasting field."

Indicative further of the disposition of the steel-mill engineer to seek out and apply new developments were papers on the effect of "health" lamps on physical wellbeing and efficiency and on conductors for heavy alternating currents. Another paper described the channel type of busbar recently brought out by the Aluminum Company of America. The associated interests of the electrical engineer in heat applications and in lubrication were treated in a series of papers presented in sessions parallel to the main meeting. As is always the case, a feature of the convention most valuable to the engineers who attended was the

excellent exhibition of equipments and devices for steel-mill electrical applications. It left no doubt in the mind of the visitor that manufacturers have fully appreciated the need for constant ingenuity implied by the electrical developments committee report.

▼

Portland and Boise Companies Under Review

RESUMING ITS INQUIRY into public utility matters on Tuesday of this week, the Federal Trade Commission heard from several of its examiners testimony concerning the financial, engineering, management and distribution operations of Western units in the Electric Bond & Share group. As announced last week the three Portland companies in this group—Pacific Power & Light, Northwestern Electric and Inland Power & Light, all subsidiaries of the American Power & Light Company—and the Idaho Power Company of Boise are the ones to be reviewed.

Tracing the financial history of the Pacific Power & Light, Edwin T. Harris brought out that properties and other net assets which cost the American Power & Light Company $4,767,572 were sold to the Pacific company for a consideration of $10,447,000. The difference in these items of $5,679,428 represents excess costs to the last-named company over costs to American Power & Light, the examiner testified.

Mr. Harris also stated that the growth in book values of fixed capital from the organization of the Pacific company in 1910 to the end of 1929 amounted to $11,220,733 net, after retirements and property sold. Costs of additional plants purchased included in that amount aggregated $1,273,307, which was paid in cash.

▼

Calls Energy Tax Impost on Interstate Commerce

THAT SOUTH CAROLINA'S new revenue-raising tariff of 0.5 mill per kilowatt-hour on electrical energy generated or sold within the state would violate the United States Constitution by placing a tax on interstate commerce is one of the main contentions made by the Lexington Water Power Company, which, with the Broad River Power Company, is seeking a permanent injunction against the collection of the tax (ELECTRICAL WORLD, June 13, page 1086).

The plaintiff states that all of the electricity generated on the Saluda River is sold at wholesale to the Carolina Power & Light Company and the Duke Power Company, that the larger part of this electricity "is transmitted to and consumed by customers in North Carolina and that the larger part of the station use in South Carolina is in conjunction with and incidental to such generation of electricity in interstate commerce." The bill continues:

As the demand is made, the electricity demanded is instantly, and as an immediate and direct result of said demand, generated at plaintiff's said station specifically and solely for, and in response to, that demand and use.

The meter or meters required by said tax act to be maintained by the plaintiff will record, and must record, expressed in terms of kilowatt-hours, the mathematical product of the power relation in the electric circuit between the generators of said system in South Carolina and the receiving devices in North Carolina, measured in kilowatts, and the duration of time over which that relation is utilized, measured in hours, including, in the measurement, the energy expended in the system to meet losses and other necessary uses incident to the delivery of energy to such receiving devices. The measurement, therefore, upon which the tax sought to be imposed by said tax act is based is, and will be, a direct measure of the magnitude and duration of interstate commerce in electricity or electric energy over said system, after said commerce has commenced and during the course thereof.

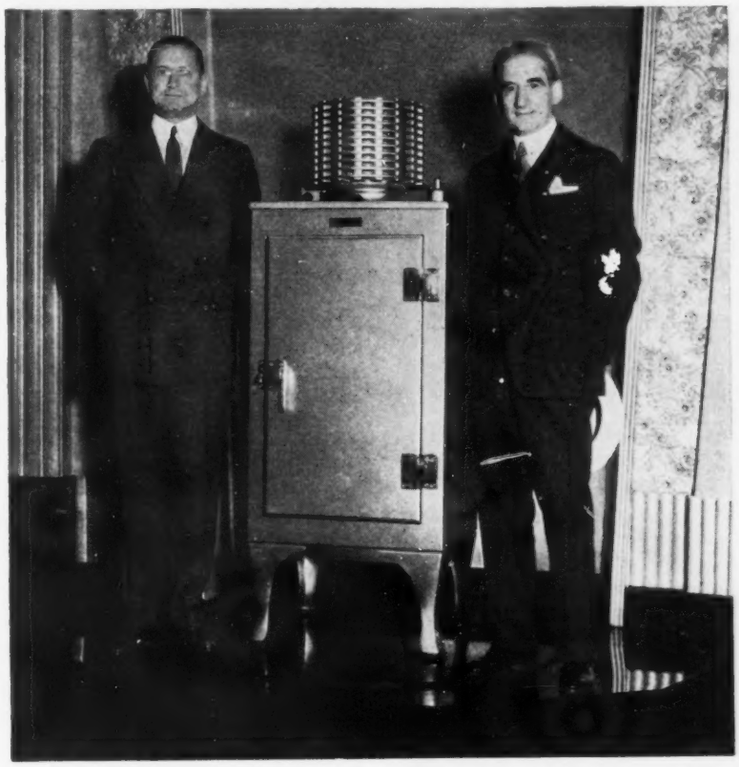
The generation of electricity is not the production of a commodity or material thing; it is a part of the process of rendering a service, and no electricity can be commercially generated or produced except as an inseparable part of the service rendered. Likewise the "kilowatt-hour" is the measure of such service and not a measure or unit of material things.

The plaintiff further avers that the defendants threaten to assess a tax against all electricity generated by the plaintiff, and that any tax levied or assessed against the electricity so generated and used in interstate commerce is void under the provisions of the United States Constitution as a burden on interstate commerce.

The tax act contains no provision or means for measuring or computing separately the amount of the tax as applied to intrastate as distinguished from interstate commerce and is therefore void in its entirety.

A veto of the energy tax bill by the Governor of South Carolina was unsuccessfully urged in a vigorous message from the Charleston Board of Trade, with 800 members, which declared that "the onward march of the Palmetto State to industrial and agricultural independence" would be imperiled by it.

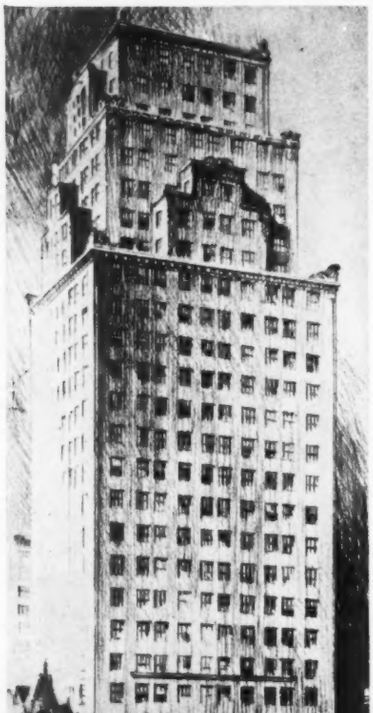
ONE FIRM MAKES MILLION REFRIGERATORS IN FOUR YEARS



An article which attracted much attention in the N.E.L.A. manufacturing exhibit at Atlantic City last week was the one millionth General Electric refrigerator, gold-plated and conspicuously displayed. In the picture it is flanked by M. S. Sloan (left) and Gerard Swope. Tonight Mr. Swope presents it to Henry Ford for the Edison Institute, over a nation-wide radio hook-up.

▼ ▼ ▼

STONE & WEBSTER'S NEW OFFICE BUILDING



More than one-third of the new 25-story limestone building put up by Stone & Webster, Inc., on Broad Street, New York, is occupied by that firm and its affiliated companies.

▼

Illinois Has Passed One Out of 20 Utility Bills

AN ATTITUDE OF *laissez faire* concerning public utilities has dominated the Illinois General Assembly, which was expected to adjourn on June 20. Only one out of nearly 20 utility bills had passed both branches as this was written. This was the Snell bill, permitting city officials to set up separate funds for proceeds of municipally owned public utilities and to invest any surplus, which passed the Senate with amendments by 35 to 4. The bill went back to the House for concurrence in the changes, which provide that the municipal utility funds established shall be subject to audit in the same manner as are private utilities.

A bill providing that neither the mayor nor commissioners of cities under the commission form of government shall be officials of any public service corporation had passed the House.

Representative Barnes' bill to prohibit utility companies from engaging in the retail business is dead. A subcommittee reported on it adversely and recommended that a state commission be set up to study the question and submit a report to the next Legislature. The report held that the question is purely a legal one which could better be threshed out by a commission. But that recommendation was not accepted.

Efforts of private interests to put municipally owned utilities under the jurisdiction of the Illinois Commerce Commission failed, as did the efforts of municipal bodies to acquire control of all utilities in their territory by abolishing the Commerce Commission and to organize utility districts to include a number of interdependent cities, each district to have taxing power. "What killed the municipal bills," said Frank A. McCarthy, chairman of the House committee on public utilities and transportation, is the fact that stock in privately owned utility corporations is held by such large numbers of people that there is no public demand for municipal ownership."

The utilities district bill was tabled in the Senate committee on corporations and municipalities, and the Senate bill requiring the Commerce Commission to publish a comparative statement of public utility rates was tabled by the committee on public utilities.

All other utility bills died in committee. These included among House bills one creating a legislative commission of five to investigate rates, one withdrawing from the commission jurisdiction over operation of utilities and vesting it in the city authorities, one abolishing the commission entirely and one prohibiting aerial high-tension lines, as well as Senate bills authorizing the resale of service by municipal utilities and requiring utility companies to sell service to municipal corporations without discrimination.

Power and Regulation in Other State Legislatures

ALABAMA.—The Lower House has taken from its adverse calendar the bill increasing the license tax on electric power utilities from 4 to 8 mills on each $1 of gross receipts. A bill introduced in the Senate would take from the Public Service Commission jurisdiction over all utilities except railroads and bus lines and place regulation of electric and gas companies under a body to be known as the Public Utilities Commission of Alabama. The bill makes specific provision for determining valuations.

FLORIDA.—The Senate in special session has passed a bill to levy a tax of 1½ per cent on the gross revenue of electric and gas utilities, including those municipally owned, and on the intrastate business of telephone and telegraph companies. An effort to exempt municipal gas and electric plants from the tax failed, and the bill was passed by 24 to 11. An attempt to prevent utilities from merchandising met defeat in this session, as had the previous effort to tax electricity ½ cent a kilowatt-hour.

WISCONSIN.—The bill to create a state utility corporation was passed by the Senate on June 11 by a vote of 16 to 15. Its approval by the Assembly and Governor is considered certain. The Loomis municipal competition bill and another municipal competition bill, fathered by Senator Langve, were both killed by the Senate on June 17 by votes of 16 to 15. These bills would have allowed municipalities to compete with private companies which are already serving the communities.

▼

How Commission Would Lower Washington Rates

PROPOSED MODIFICATION of the consent decree under which electric rates for Washington, D. C., are determined, as put forth by the Public Utilities Commission of the District of Columbia and noted last week (page 1088), comprises the following features:

The rate base valuation used in the consent decree, approximately $50,000,000, is retained for the present, but a loophole is provided for a general valuation of the power company's properties at a later date if such a course is thought wise. The order states that the rate base "shall be determined by taking the last value ascertained prior to the beginning of said period (any twelve months), adding thereto the net additions and betterments up to the beginning of said period, and then adding thereto the net additions and betterments during said period, undepreciated, but weighted."

Electric rates may be reduced or adjusted at any time during the year instead of the first of each year, as under the consent decree, and they may be cut two or more times a year if the excess profits of the utility run much higher than anticipated when the previous reduction is made.

The power company's basic rate of return is cut from 7½ to 7 per cent, while the public is to get a greater share of the excess profits, in electric rate reductions for the subsequent year, than under the 50-50 division in the consent decree. From 7 to 8 per cent the sharing will be half and half; from 8 to 9 per cent it will be three-fourths for the public and one-fourth for the utility, while five-sixths of all over 9 per cent will go for rate reductions.

Provision is also made, as in the former sliding scale but with different percentages, that if the average return of the power company falls below 6¾ per cent for any consecutive five-year period, or if it falls below 6½ per cent for any consecutive three-year

period, or below 6¼ for any twelve months period, the commission shall promptly increase the rates.

In the opinion of the commissioners all of the benefits of the consent decree, without its disadvantages, would be retained by the proposed modification of the existing arrangement.

▼

Engineers Investigate the Skokomish River

WIDE ENGINEERING STUDIES of the Skokomish River are to be made by the Tacoma municipal authorities at the behest of the Federal Power Commission, because of the city's proposed further diversion of the waters of the stream.

Hydraulic studies on the rivers's South Fork will be made under the supervision of J. V. Gongwer, who has been superintendent of hydraulic design and construction on the second unit of the Cushman power project, now nearing completion. A study of the valley ground waters will be made under the direction of Ross K. Tiffany, former state supervisor of hydraulics. These studies will have an important bearing upon the suit of farmers for additional damages for diversion of the waters of the North Fork, as well as on the amount of damages to be incurred by diversion of the waters of the South Fork.

Two Utilities to Join in Lighting Hudson Bridge

UNDER AN ARRANGEMENT similar to that now in effect in the Holland Tunnel, the Public Service Electric & Gas Company of New Jersey and United Electric Light & Power Company of New York will each furnish half of the electrical energy for illuminating the new George Washington Bridge across the Hudson River. The span will be lighted by 230 lamps of 500 watts capacity each, spaced on opposite sides of the roadways on the bridge proper. These lamps will be mounted on standards 18 ft. high to the light center and will be spaced approximately 90 ft. apart along the length of the roadway. The lamps to be serviced by each company will be staggered or alternated so that if one of the services is interrupted half of the lamps on the bridge will remain lighted and thus provide temporary illumination for the entire length of the roadway.

The approaches on the New Jersey side of the bridge will be floodlighted from equipment mounted on the top of two ornamental floodlighting towers, which are to be 100 ft. in height. These towers will be needed on account of the width of the roadway leading out from the bridge proper. In addition to the roadway and approach lighting, the cables which support the bridge will be lighted by 200 lamps of 50 watts capacity each, suspended from the upstream and down-stream cables. These lights are intended to show the general curve of the cables at night so that aviators may avoid them. On the top of each of the two towers on the bridge there will be installed two Department of Commerce air beacons.

▼

Federal Power Board Issues Two More Permits

A PRELIMINARY PERMIT covering a project on the Tellico River in Tennessee has been issued by the Federal Power Commission. The applicant is the Mountain Power Company of Chattanooga, which desires to construct a series of six power dams and possibly three storage dams in a sector of the river 22 miles long. It is planned to install 55,000 hp. McDonald & Company, Atlanta, are the engineers for the apllicant.

A preliminary permit has been authorized also for the West Penn Power Company, covering a possible development of power on United States Dam No. 8 on the Allegheny River. This dam is now under construction. The power company asks permission to investigate the possibilities of installing equipment to generate 31,000 hp. at the navigation dam.

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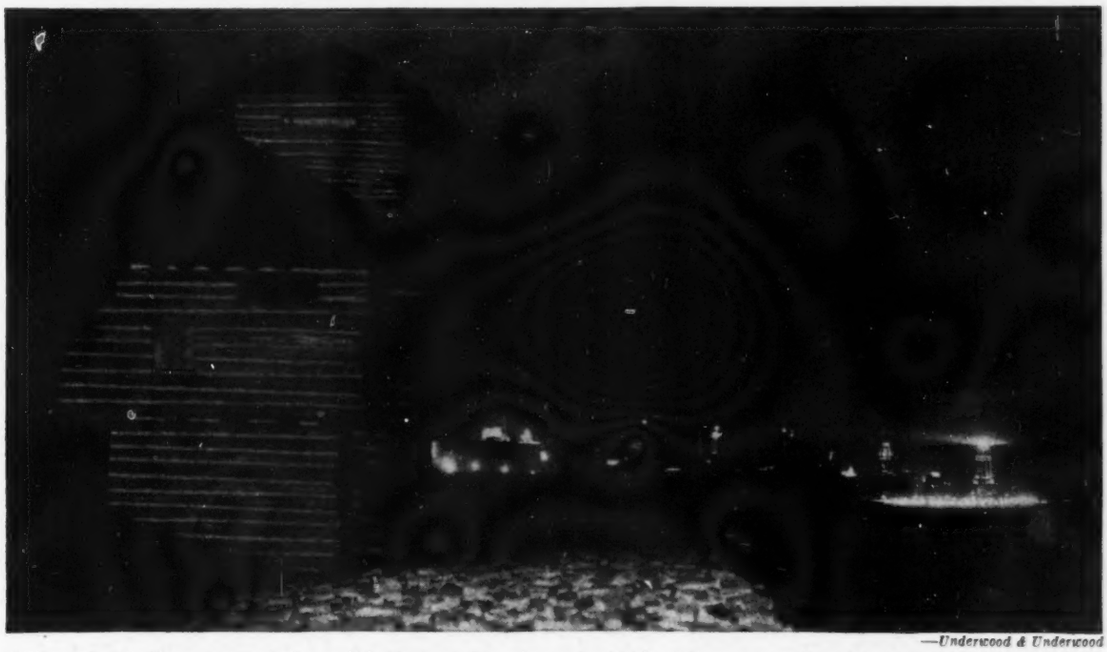
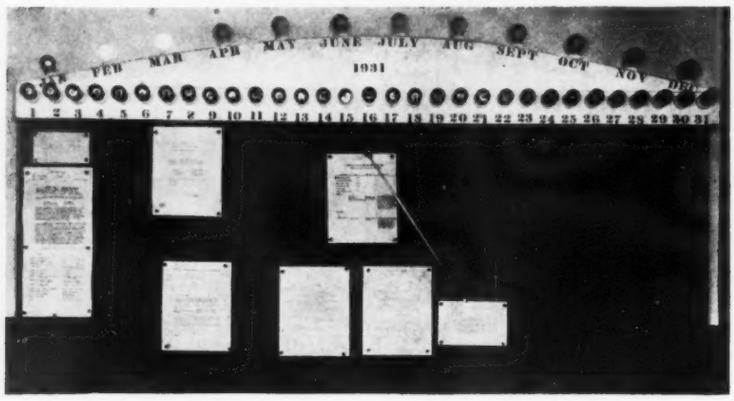
ANCIENT FORT DEARBORN CONFRONTS CHICAGO'S CENTENARY SKYLINE



—Underwood & Underwood

When the Indians burned the original Fort Dearborn in 1812 Chicago, had it existed, would have had its first illumination; but it would not have compared with the electric one seen nightly in this centenary year of the city, into the glare of which the photographers have brought this World's Fair replica of the famous fort.

A DISTRIBUTION DEPARTMENT ACCIDENT CALENDAR



A novel board for recording accidents in the distribution department of the El Paso Electric Company has been installed in its service building. Twelve lamps along the upper border provide a light for each of the twelve months. Below is a row of 31 lamps, one for every day in the month. Red lights flash on and off; green lights burn steadily.

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Oregon Grange Asks State to Develop Hydro Power

MOVEMENT TO put the State of Oregon into the power business was initiated June 11 by the Oregon State Grange, meeting at Medford, through the adoption of a resolution authorizing the executive committee to draft an amendment to the state constitution empowering the state to develop hydro-electric power. The resolution was introduced by Kenneth Harlan of Carey & Harlan, Portland rate engineers, with the statement that it was designed to carry out the public ownership policies of the late George Joseph, recent gubernatorial candidate, and of Governor Julius Meier, elected on the Joseph platform.

The proposed amendment, a draft of which is said to have been commended by the Grange executive committee, is expected to empower the state to construct generating plants and transmission lines and to wholesale power to private corporations and publicly owned utility districts and municipalities. The amendment is to be prepared in time to be initiated at the next general election.

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Rural Service Gains in Southeastern States

GAINS AGGREGATING in 1930 more than 10,000 in the number of farms with electric service in the seven Southeastern States—Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama and Tennessee—are reported by Chairman E. C. Easter of the rural electric service committee, Southeastern Division, N.E.L.A. This is an increase of 28.4 per cent, the figures for January 1, 1931, being 46,393 and those for January 1, 1930, 36,154—an excellent showing for a year of bad business.

Seventeen power companies have rendered reports which show that they are serving 116,000 customers outside of towns with 1,000 or more population from slightly more than 10,000 miles of distribution line. Of these farmers 23,956 use an average of 892 kw.-hr. per year per farm as compared with an average annual consumption of 705 kw.-hr. a year ago, an increase of 26.5 per cent. The companies reported 143 farm customers who use an average of 8,430 kw.-hr. per year per farm. In this group are all of the different types and sizes of farms to be found in the Southeastern States, and the uses of electricity represented are only those that can be satisfactorily made by any successful farms of the same types.

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Nebraska Rural Service Makes Moderate Gains

TWO MEMBERS of the department of agricultural engineering, University of Nebraska, E. E. Brackett and E. B. Lewis, have published the results of an inquiry into rural electric development in that state. For the three years from 1927 to 1930 a greater increase than in any similar period was recorded, 1,400 farms being added to service lines, bringing the total to approximately 4,000.

Municipal-plant service to farms is reported as almost inconsiderable. Reports from transmission-line companies show construction costs varying from $650 to $1,100 a mile, exclusive of transformers and service connections, with an average cost of $860. Maintenance varied from $4 to $50 a mile per year, with an average of $26; energy loss ran from 12 to 50 per cent, with an average of 26 per cent. and operation cost varied from $4 to $20 per mile, with an average of $12.50. The investigators say that there is general acceptance of the view that farm-line extensions should be self-supporting and that each line should produce an income to the contral station of from $6 to $10 a month.

Figures included show average annual revenue from designated lines of $124.63 a mile and $70.84 a consumer; annual kilowatt-hour consumption per consumer, 467; revenue per kilowatt-hour, 15.3 cents; average customers per mile, 1.64.

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Scattered Happenings in the Electrical Sphere

UNITED STATES

Mercury-Vapor Turbine for Long Beach?

Southern California Edison Company executives are studying the progress of the mercury-vapor turbine being developed at Schenectady by the General Electric Company, with the view of adopting this type of equipment for the next 100,000-kw. unit at the Long Beach station, according to an announcement made June 8 by Fred B. Lewis, vice-president and assistant general manager.

Bremo Bluff Station Now in Service

Construction work on the new steam generating plant of the Virginia Public Service Company at Bremo Bluff, Va., is virtually completed and the plant will soon be placed in service. It has an initial installed capacity of 30,000 kw., which will later be increased to 100,000 kw. and ultimately to 200,000 kw. It will be the base-load plant for the entire interconnected system of the company, bringing service to 277 communities. A double-circuit 66-kv. transmission line has been built from the plant to Charlottesville.

Uniform Rates in Indiana Opposed

In a cross-bill filed with the Public Service Commission of the state the city of Bloomington, Ind., opposes strongly the application of the Public Service Company of Indiana for permission to adopte a uniform tariff in its southern Indiana territory, comprising 67 communities. The city wishes to wage an independent fight for lower rates, and its views are understood to be shared by local authorities in New Albany also.

Rate Revisions in Oregon

Application of the urban domestic rate to the rural customers of the Yamhill Electric Company, Newberg, Ore., a subsidiary of the Pacific Northwest Public Service Company, has been ordered by the Public Utilities Commissioner. The former rural rate had a top step of 10 cents, while the top step of the urban rate is only 8 cents. A readjustment of the rural rate of the Portland General Electric Company was effected last month permitting use of farm equipment on the domestic rate up to the capacity of a 5-kw. transformer. This company, which serves more than 7,500 farms, has formed a rural electric service department under the direction of L. C. Moore. A reduction in all schedules of the municipal power department of Eugene, Ore., which has completed its steam standby plant, has been announced. Domestic rates are reduced 13 per cent, commercial lighting and power tariffs approximately 9 per cent.

Pennsylvania-Maryland Merger

A change in the set-up of the Philadelphia Electric Company's smaller Susquehanna River territory subsidiaries has been approved, to be effected through the merger of the Conowingo Electric Light & Power Company (which has been sold to the Southern Pennsylvania Power Company) and the Northern Maryland Power Company to form the Conowingo Power Company and the subsequent sale of the new company to the Susquehanna Utilities Company, a Delaware corporation, for $555,038.

Kansas Gas & Electric's New Building

A new architecturally attractive service building was opened in Wichita recently by the Kansas Gas & Electric Company which, costing $400,000 and equipped in the most modern manner, is believed to be the finest structure of its kind in the state.

Electro-Metals Company Gets Damages

A bill appropriating $250,000 to reimburse the Electro-Metals Company, San Francisco, for expenditures on an electrometallurgical enterprise on the Lower Klamath River has been signed by the Governor of California. The company's extensive and authorized plans for this 100,000-kw. enterprise were frustrated in 1924 when an act sponsored by the California Fish and Game Commission made it unlawful to erect any dam in the Klamath River between its confluence with the Shasta River and its mouth.

Holston River Project Seeks Approval

A hearing will be held by the Corporation Commission of Virginia on July 9 on an application from the Holston River Power Company of Johnson City, Tenn., for permission to flood lands on the Tennessee border. The company desires to build in Tennessee an earth-fill dam 210 ft. high which will back up Holston River water for 20 miles. An initial 34,500-hp. plant is to furnish power for electrochemical and other industries, according to the recorded application.

New Oklahoma-Arkansas Link

By a 63-kv. transmission line, nearly completed, using 95-ft. poles, the Lincoln Power Company plant near Howe, Okla., 40 miles southwest of Fort Smith, Ark., has been connected to the latter city's distribution system, giving Fort Smith two-way service from the adjoining state, a line from Muskogee being already in operation.

Electrical Merchandising in Kentucky

Agitation against the sale of electrical appliances by light and power companies has been begun by the Kentucky Hardware & Implement Association, which wishes to see a bill forbidding this practice introduced at Frankfort when the Legislature meets next year. This year there was no session.

Crisp County Plant to Advertise

After ten months of continuous operation, officials of the Crisp County power plant at Cordele, Ga., have launched a campaign to widen its availability, according to Emmett S. Killebrew, designing engineer of the county-owned development. This campaign will embrace eight weeks of national advertising to induce new industries to settle in Crisp County tax-free under certain conditions, as well as to increase the local use of electricity, especially for heating purposes. According to Mr. Killebrew, the gross receipts of the plant are now $100,000, which is enough to pay operating expenses, interest on bonds, and retire a part of the principal.

Mackinac Island Submarine Cable

Completion this summer of the work of laying 16,000 ft. of high-voltage submarine power cable to connect Mackinac Island with the upper Michigan peninsula is promised by the Edison Sault Electric Company and the Mackinac Power Company. This is the first step in a program to be completed this year which will bring hydro-electric power from St. Mary's River at Sault Ste. Marie to St. Ignace, Mich., and thence to the island.

Violet Rays for Seaside Hotel Patrons

A new system of lighting with ultra-violet rays is being installed in selected rooms of the Ritz-Carlton Hotel at Atlantic City. Separate circuits on each light fixture will control separate bulbs for reading, so that unpropitious weather outdoors need not prevent patrons from basking in the sun.

CANADA

Abitibi Power's 260-Mile Line

In the coming year hydro-electric power will reach the Sudbury mining field of northern Ontario over a 132-kv., 260-mile transmission line running to Abitibi Canyon, 68 miles north of Cochrane. The power is being developed by the Ontario Power Service Corporation, a subsidiary of the Abitibi Power & Paper Company.

Beauharnois Complications

Bankruptcy proceedings against the Transportation & Power Corporation resulting from disputed legal fees have given a new turn to that company's action for $10,000,000 against R. O. Sweezey and others and the Beauharnois Power Corporation. The action against Beauharnois is what led to the appointment of a parliamentary committee to investigate the company (ELECTRICAL WORLD, June 13, page 1087). An interim receiver has been appointed to take over the Transportation & Power Corporation books, but the company is contesting the receivership order.

ABROAD

Second Part of Scotch Power Scheme

A start has been made with the second stage of the British Aluminium Company's hydro-electric power project at Lochaber, Scotland. This work entails the raising of the water level of Loch Treig by about 36 ft. through the construction of a tunnel aqueduct between Loch Laggan and Loch Treig and a dam at the end of the latter.

Coming Meetings

American Society of Agricultural Engineers — Ames, Iowa, June 22-25. Raymond Olney, St. Joseph, Mich.

American Institute of Electrical Engineers — Summer convention, Asheville, N. C., June 22-26; Pacific Coast Division, Lake Tahoe, Calif., Aug. 25-28. F. L. Hutchinson, 33 W. 39th St., New York.

Pacific Coast Section, N.E.L.A.—Del Monte, Calif., June 24-27. K. I. Dazey, 447 Sutter St., San Francisco.

Camp Co-operation XI — Association Island, Henderson Harbor, N. Y. July 27-31. Society for Electrical Development, 420 Lexington Avenue, New York.

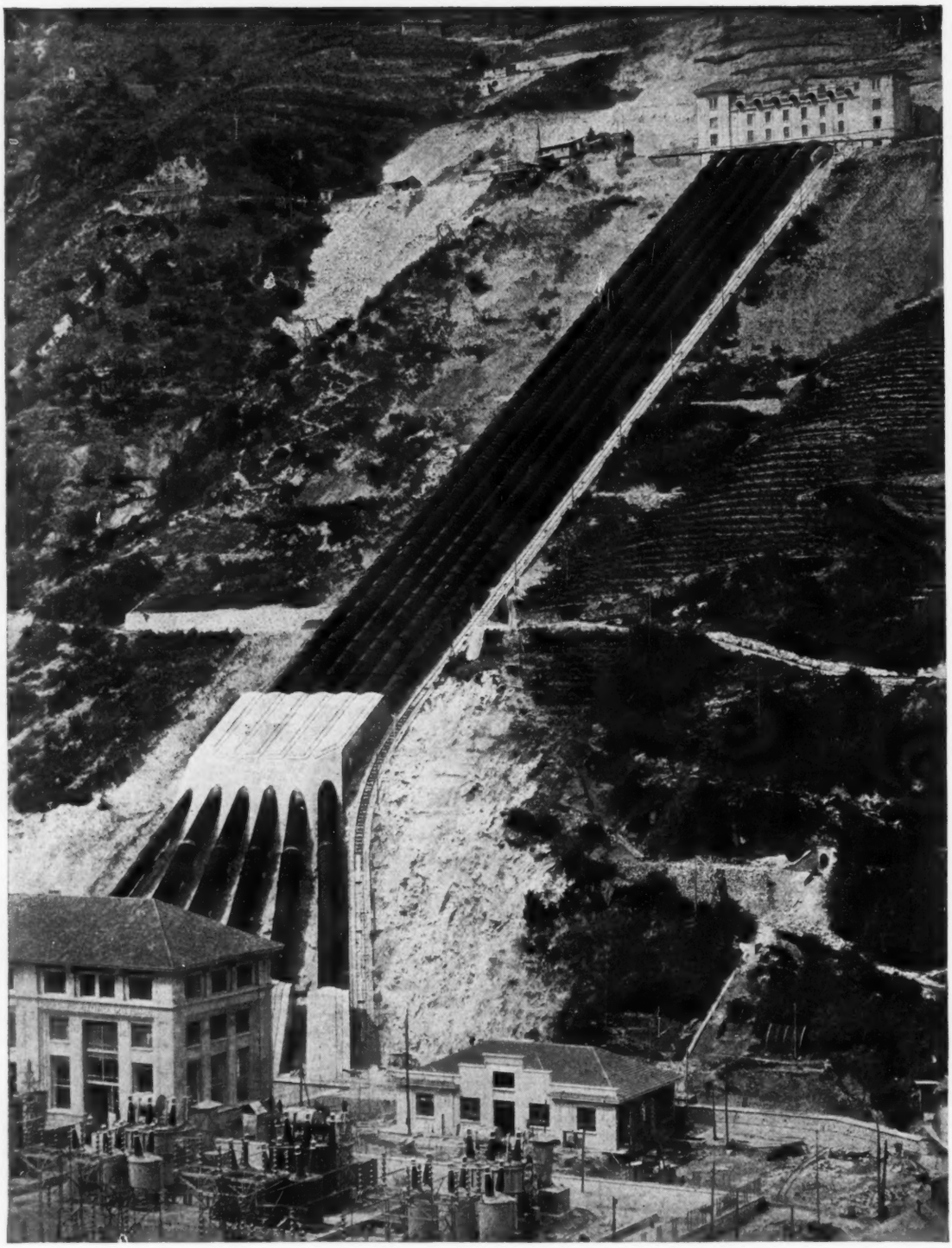
Rocky Mountain Division, N.E.L.A. —Stanley Hotel, Estes Park, Colo., Sept. 2-4. G. E. Lewis, 367 Gas & Electric Bldg., Denver.

Electrochemical Society—Hotel Utah, Salt Lake City, Sept. 2-5. C. G. Fink, Columbia University, New York.

Pennsylvania Electric Association — Bedford Springs Hotel, Bedford Springs, Pa., Sept. 9-11. H. A. Buch, Telegraph Bldg., Harrisburg, Pa.

Empire State Gas and Electric Association—The Sagamore, Bolton Landing, Lake George, N. Y., Sept. 10-11. C. H. B. Chapin, Grand Central Terminal, New York.

New England Division, N.E.L.A.— Poland Springs House, South Poland, Me., Sept. 28-30. Miss O. A. Bursiel, 20 Providence St., Boston.



Cardano,
a 270,000-hp., 540-ft. head
Italian plant

(See page 1174)

EDITORIALS

L.W.W.MORROW
Editor

No time for executive blues

BOTH President Hoover and Leonard P. Ayres said this week that the depression has reached a stage at which the fear and apprehension of executives are the greatest stumbling blocks to recovery. They call for appraisal of the other side of the picture, the President observing that the empty hole in the doughnut should not focus the entire sight.

Other authorities believe that the resistance level of the depression has been reached and approve the counsel of courage and faith as the means to get business out of the doldrums. Under these conditions there is every inducement for the utilities to take the lead. They have suffered less in net earnings than any other business; they are in such intimate contact with communities and individuals that their positive influence can be made especially effective; they have the greatest undeveloped markets waiting development, and they have the incentive to protect the American system by stimulating their employees and friends to renewed efforts for business recovery.

Yet in many instances utility executives are showing fear and apprehension, especially those in financial control and in a financial environment. They have rubbed elbows with bankers and succumbed to the disease of timidity and deflation. These policies have been reflected in local managements to the detriment both of new business and the morale of employees. Too frequently the orders have been, "Spend no capital, no matter what the returns, and cut expenses to absolute essentials." There is no construction, so engineers and construction forces are eliminated. There is no money, so new business cannot be acquired, improved equipment cannot be purchased and more economical operation cannot be put under way.

This executive policy is bad business and bad public relations. Under the present trying economic and political conditions every effort should be made to improve employee morale, operating efficiency and sales technique. It is no time for executives to have the blues, even though it is a time for expert business management. Fear and apprehension will not become epidemic if courageous and alert utility executives inspire inactive colleagues to climb out of the slough of despond.

Test case might restore free sale of equipment

IN EXTENDING desired protection to household equipment distributors on their installment sales a recent amendment to the personal property law of New York State puts a serious handicap in the way of business. Under this amendment the conditional bill of sale must contain a description of the real property involved and the name of its owner, thus virtually becoming, when officially recorded, a mortgage on the real property, subordinate to prior mortgages.

Formerly distributors of elevators, heaters, refrigerators and similar equipment simply had a conditional bill of sale filed in the county clerk's office. There was no question of a lien on the real property. After abuses had led to the introduction of the amendment referred to, some title and mortgage companies found a way of safeguarding their interest by withholding final payment to the builder until he presented a clean bill of health for all the equipment he may have contracted to buy on installments. Where this is not obtainable they demand subordination of the seller's rights in such equipment, leaving him virtually without security.

As a result of this allegedly unwarranted inter-

ference with the free sale of goods some of the largest manufacturers have stepped aside and prefer to lose the business rather than to take the risk involved. A large volume of the business has in consequence recently gone to smaller concerns.

Although the title and mortgage companies appear to have the whip hand at the moment, manufacturers and distributors believe that their action is untenable. Texas courts have held that refrigerators in an apartment retain their character as personalty and that the conditional vendor can remove them "as against a prior mortgage of the building, since they did not impair the security." With slight variations New York State and Florida courts have taken the same stand. A most important decision came from the Supreme Judicial Court in Suffolk County, Mass., on March 3, 1931, which reversed a prior decision by another court and held that two compressor units and 54 refrigerators in an apartment house were not real estate but personal property, title to which remained in the seller until the full payment of purchase price, "except the piping, which runs through the walls and partitions." A test case in New York State might change the entire situation.

Air conditioning to the front!

IT HAS come to pass that a railroad coach has been made more comfortable than homes and expensively equipped private offices. The Baltimore & Ohio Railroad has installed air-conditioning apparatus on passenger cars that maintains purified air at constant temperature and constant humidity. There is no central air-conditioning plant on the train, but a standardized unit, consisting of heater, refrigerator and air washer, driven by a gasoline engine, is provided on each car.

If it is considered good business to operate these units on railroad cars by the use of gasoline engines, it should be better business to use standard units with motor drives in private homes, offices or public places. There are thousands of homes and private offices where money to purchase comfort and convenience is available. There are stores, theaters and restaurants where thousands of dollars are spent annually to attract and please customers. These would certainly not object to spending a comparatively small amount to provide a comfortable temperature and clean air for themselves and their clients. Enterprising utility executives, in co-operation with manufacturers, might well take the initiative and install air-conditioning equipment in their own private offices and homes and also develop the available markets. Load builders of the electrical industry should not allow railroad men to make them trail new business paths for very long.

Prejudices on the other side too

FREQUENTLY enough it has been said that the principal obstacle in the way of any large economy of national scope through the interconnection of utility and industrial power plants is the disinclination of utility executives to think of their occupation in any other light than as suppliers of electrical energy. Though this charge is undoubtedly true in too great a number of cases, it must in fairness be recognized that as great an obstacle lies in the disposition of many executives and engineers of large industrial firms to regard their operations in the generation of electricity with complacent self-sufficiency and to look upon utility proposals for interconnection with suspicion and distrust.

It is natural that high executives of industrial companies should primarily be occupied with the problems of their own business and that they should rely greatly upon the opinions of their engineers and plant operators in matters affecting electricity supply for manufacturing processes. It is natural also that these engineers and plant executives, having been long accustomed to an isolated plant as a part of the manufacturing economy, should be predisposed to a continuance of independent electrical operation. To a considerable extent these men fear for their own positions, which might be threatened or abolished by utility participation in their particular power-supply problems. To a degree also they lack knowledge of cost accounting and are deficient in commercial sense, being therefore unable to appreciate the economic advantages that might accrue from a utility connection.

However, just as the resistance of the utility executives will be worn away by continued and

increasingly pertinent discussion of the problem, so as well will the balky disposition of the engineer in industry be overcome. The remedy is the same in both cases. Discussion creates opinion, which in turn bears down heavily on prejudice and in time obliterates it. Then the facts can prevail.

Electricity and gas do not mix well

GAS and electricity seem to have been invested with more or less natural antipathy toward one another. Gas in a circuit breaker is no unmixed blessing because of its explosive rupturing tendency. Gas in the interstices of cable insulation is a source of distress and harmful waste of energy. More recently we have learned that magnetic hysteresis losses are due to gas between the magnetically orienting molecules. "Hipernik" bars the viscous gas and prevents its interference with the hectic magnetic reversals of the molecules.

As concerning gases of a different breed, the electric currents in cables resent the present of those gases in ducts and manholes, occasionally manifesting the displeasure by precipitating a bit of highway excitement. Even gas in a kitchen range irritates the electrons, which long for an opportunity to supplant the usurper. The lack of amity in this field is not so different from that in the storage battery, where gas is expelled when electricity forces its way in. Many gases of different behavior work with or against electrons.

Verily it seems that gas and electricity were not destined to mix. Fortunately they do occasionally live together in tolerant restraint under a single corporate master, but even here the mutual irksomeness displays itself once in so often in contradictory advertising claims. So far this lack of concord and affection between the two elements has resulted in more victories for the electrons than for their gaseous competitors. But the former will do well to recognize that gas still has much the upper hand in the field of space heating and may even some day have to be acknowledged as the principal source of the heat through which nature's potential energies find their expression in the amazing usefulness of the electron.

Why not humanize credit and collection technique?

PROSPECTIVE customers in forming their initial opinion of the "personality" of a utility are influenced by the degree of rigidity they meet in obtaining service and also by the promptness with which the work is done. The established customer, likewise, is prone to assume an unfavorable attitude if a harsh routine is employed in connection with any temporary failure to pay. These two moments in a customer's relations with the company stand out far above the intervening months and years of smooth-functioning service and unobtrusive billing. Their psychological prominence justifies a degree of attention to these business details in proper proportion to their bearing on the good will of the community, for in the last analysis the good will of the community is merely an aggregate of individual sentiments and prejudices founded principally on such episodic experiences.

Why, for example, when a customer moves should there be for each company that leaves the service instantly available two that disconnect service? Why should a big company be content with initial deposits from seven per cent of its customers while another company with one-twentieth as many customers requires deposits from all of them? Why should not the established credit standing of the customer be investigated in the first instance and periodically in connection with the waiving or return of the deposit? Just how much more vigor is appropriate for a utility dealing with a "slow-pay" customer than is current practice with commodity retailers recovering on defaulted installment payments?

Here are elements intimately affecting the customer's kindliness of feeling toward his utility. There can be only one fundamental answer to each of the questions. The diversity of treatment that prevails as disclosed by a recent survey report of the customers' records committee of the N.E.L.A. Accounting National Section is something which should lead to a more nearly common denominator and thus aid public relationship at the very point where much of it goes awry—the customer's pocketbook and his justifiable sense of individuality and pride. Credits and collections offer a tangible approach to practical public relations.

Economic Operation of Electric Enameling Furnace

By A. M. YOUNG

Public Service Company of Northern Illinois, Chicago, Ill.

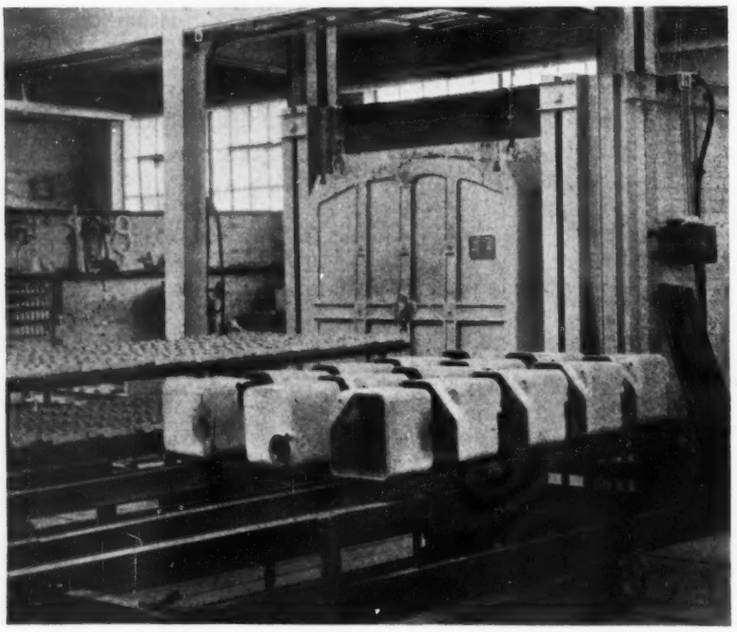
A DIFFERENCE of nearly 13 per cent in the net rate for furnace energy from one month to the next was disclosed by a recent study of an electric enameling operation in the plant of the Chicago Hardware Foundry Company at North Chicago, Ill. This difference was caused by varying incidences of furnace demand on total plant demand. Although the customer had proved conclusively that the recently installed electric furnace was producing economically a quality of work that had been impossible with the previous oil-fired furnace operating under like conditions, the electric heating division of the Public Service Company of Northern Illinois made an exhaustive study of the operation of the installation. From a standpoint of quality of product and economy of operation the results of this study fully justified the customer's conviction, and in addition presented conclusive proof that there are additional savings to be made in using the electric furnace, by taking cognizance of certain of its inherent operating characteristics.

The object in making this study was threefold, namely, to determine the results obtained from the electric furnace with respect to: (1) Production. (2) Power cost. (3) Improving operating methods.

The furnace in question is a 215-kw., ribbon-resistor, box-type unit, with a rated maximum temperature of 1,700 deg. F., and is equipped with a standard type of recording temperature control. In preparing the material for firing in this furnace the "wet" process of enameling is used. All material enameled is cast iron. The products that pass through the furnace are as varied in weight, size, shape and in use as it is possible to conceive and among the products enameled will be found water tanks for mechanical water coolers. These tanks occupy a cubic foot and weigh 50 lb., yet following these into the furnace may be a load of penholders but a few inches square and weighing only a few ounces.

Information on the production of this furnace was obtained throughout six days of normal furnace operation. A careful study of the results secured during the production test brought out a number of interesting facts. It was immediately evident that the great variation in material had a decided effect upon the economies possible in the furnace. It is easily seen that where a furnace is running on a production basis, with only one or two types of finished products, the time, temperature, weight of support bars and arrangement of charge can be so adjusted that economies can be effected which are impossible with a furnace doing jobbing work.

The customer's power is purchased on a demand and energy charge basis, the demand charge being made on the maximum

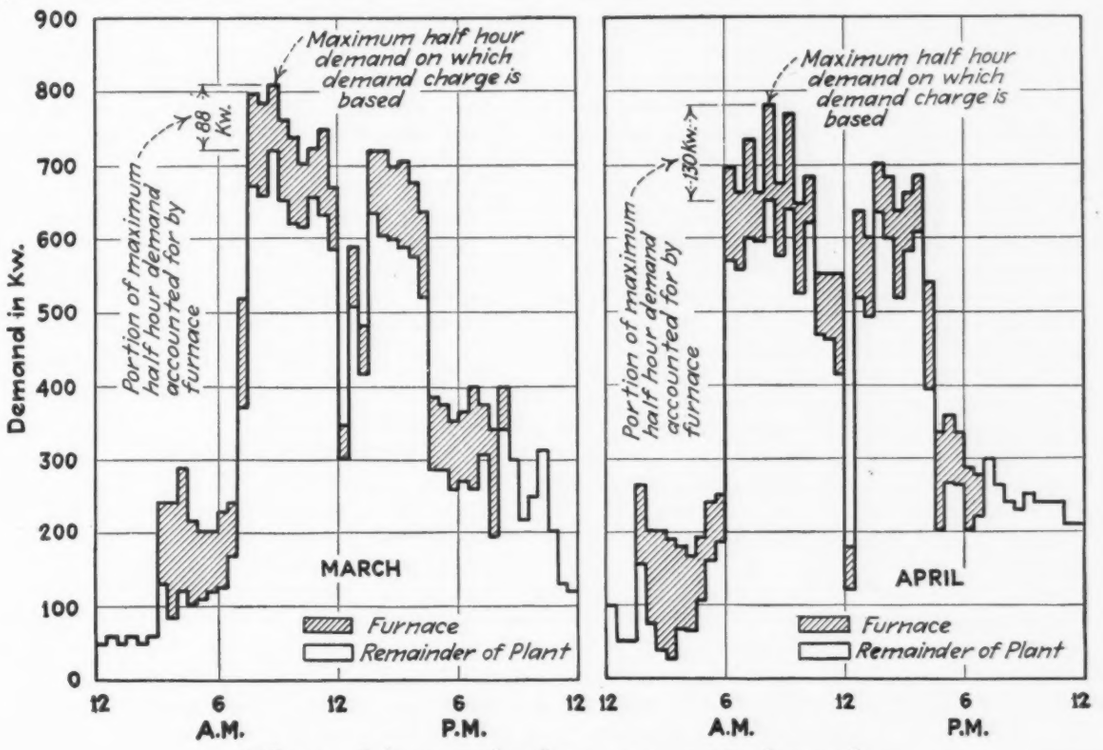


Furnace handles variety of products

Just out of the heating chamber is a load of fifteen refrigerator parts, each weighing 50 lb. Ready to go in are 300 flat ironsides of 1¼ lb. each. Penholders, bathroom hardware sets in many shapes and colors, sandwich shop chair backs in black and scarlet, stove parts, street light canopies, practically every kind of enamel cast-iron article passes in and out of this furnace. And quality is burned into every piece. Notice the clean, well-lighted room, kept that way easily because of the cleanliness of the electric furnace.

half-hour demand of the month; hence, in calculating the furnace's portion of the demand charge the half-hour demand of the furnace which occurred simultaneously with the plant maximum half-hour demand must be known. The results obtained from the study made of the furnace and plant demands are shown in the graphs. In these figures the half-hour demand of the plant is plotted with the coinciding half-hour demands of the furnace. The graphs represent conditions on the days of the months when the billing demands occurred for the furnace.

These results show conclusively the decided economy of starting the furnace early enough in the morning so that it will reach the required temperature before other equipment of the plant is started, it being during this period that the furnace establishes its maximum demand. This demand is particularly large on Mondays or days following a holiday or a shutdown. This becomes evi-



Effects of furnace load on customer's demand

For the month of March the energy consumption of the furnace was 36,160 kw.-hr. In calculating the power cost of the furnace for the month, both the demand and consumption are figured at the increment or lower rate portion as the furnace has added to the existing demand and energy consumption of the plant.

Demand Charge:	
88 kw. at $1.75 =	$154.00
Energy Charge:	
36,160 kw.-hr. at 0.8 cent =	289.28
	$443.28
10 per cent discount	44.33
	$398.95
3 per cent discount	11.97
	$386.98

Net rate = 1.07 cents per kilowatt-hour.

Suppose that instead of having a chargeable furnace demand of 88 kw. the furnace had been started late in the morning, allowing the high demand, due to bringing the furnace up to temperature, to account for a portion of the maximum half-hour demand of the total plant. This would, at a maximum, increase the chargeable furnace demand to 165 kw. Note the effect of this upon the power cost:

Demand Charge:	
165 kw. at $1. 75 =	$288.75
Energy Charge:	
36,160 kw.-hr. at 0.8 cent =	289.28
	$578.03
10 per cent discount	57.80
	$520.23
3 per cent discount	15.60
	$504.63

Net rate = 1.4 cent per kilowatt-hour.

Here might have been a net rate, chargeable to the furnace, 23 per cent larger than the actual rate had not the furnace operators realized the desirability of controlling the time of the furnace maximum demand.

This example represents a situation which might frequently occur, for although the demand of 88 kw. is low, it often happens that a furnace demand of considerably in excess of 165 kw. is registered, particularly if the furnace is cold.

Take the very conservative condition shown in the April graph, when the maximum plant demand was 780 kw., of which the furnace accounted for 130 kw. The energy consumption of the furnace for the month, of which this demand is a basis for the demand charge, was 39,520 kw.-hr.

Demand charge:	
130 kw. at $1. 75 =	$227.50
Energy Charge:	
39,520 kw.-hr. at 0.8 cent =	316.16
	$543.66
10 per cent discount	54.37
	$489.29
3 per cent discount	14.68
	$474.61

Net rate = 1.2 cents per kilowatt-hour.

If, however, the period during which the furnace was brought up to temperature had fallen within the peak demand period of the plant, the maximum demand accountable to the furnace would increase to 160 kw., with these results:

Demand Charge:	
160 kw. at $1.75 =	$280.00
Energy Charge:	
39,520 kw.-hr. at 0.8 cent =	316.16
	$596.16
10 per cent discount	59.62
	$536.54
3 per cent discount	16.10
	520.44

Net rate = 1.32 cents per kilowatt-hour.

This would have been an increase of 9 per cent in the power cost of the furnace had not the operators again realized the desirability of co-ordinating furnace starting with the plant demand.

How records were kept

The data indicated by the column heads were scrupulously determined for every one of the five days of the production study. From these records the summary of performance was derived.

Runs	Wt. of Support Bars	Type of Work	Number of Pieces	Weight per Piece	Total Wt. of Charge	Meter Reading Const.= 5.34	Kw.Hr.	Pounds per Kw.Hr. Charge (a)	Pounds per Kw.Hr. Total (b)	Time in Furnace	Time out Furnace	Time per Chge.	Temp. Deg. F	No. of Coat
	Preheat						105			7:15	7:55	:40		
1	95	1	15	50	750	0218	92.7	8.09	9.12	7:55	8:38	:43	1325	2
2	232.5	2	36	17	612	0239	112.14	5.46	7.52	8:40	9:18	:38	1340	1
3	155	2,4,3	14,19,11	17,6½,8	449.5	0257	96.12	4.67	6.28	9:20	9:55	:35	1340	1
4	232.5	2			612	0275	96.12	6.37	8.77	9:57	10:32	:35	1340	1
							69.42	4.32	7.34	10:34	11:04	:30	1330	
								7.35	11.4	11:06	11:34	:28		
									8.57	11:36				

dent when a summary of furnace demands shows an average maximum furnace demand for week days of 157 kw., while the average for Mondays or days following a shutdown is 215 kw.

It is evident that the plant peak demand is not due primarily to the electric furnace, for in no case does the furnace peak demand occur simultaneously with the plant demand. In the March graph the furnace reached a peak of approximately 150 kw. at 7:30 a.m., the plant peak being 515 kw. During the next half hour the electric furnace demand dropped to 125 kw., while the total plant demand rose to approximately 790 kw. A further study of the demand curves will indicate other intervals when similar conditions occur.

Summarizing those factors in furnace operation which have a definite effect upon its economy, the following are important and are apt to be overlooked:

The weight of support bars per charge should be kept to a minimum, both by using the lightest available pieces practical and by reducing the number used per loading as much as possible.

Each charge should be loaded with a maximum amount of product.

The furnace should be started early enough in the morning, particularly on mornings after a shutdown, so that the abnormal demand due to starting the furnace will not fall within the time of the peak demand of the remainder of the plant.

No time should be lost between charges at noon hour.

After a careful analysis of the results obtained from the operation of this electric furnace it is evident that the high quality of enameling is economically possible through:

1. Reducing of "rejects" to a negligible per cent by

(a) Accurate control of furnace temperature.

(b) Even distribution of heat throughout the furnace.

2. Low labor cost.

3. Low maintenance cost.

Add to these features the use of a minimum floor space and ideal working conditions and it is easy to understand the rapid advancement of electric heat in industry over the past few years.

What Six Days' Study of Furnace Operation Showed

During the six days of operation, represented by the accompanying summary, 89,548 lb. of iron passed through the furnace, or an average of 14,929 lb. per day. This includes both charge and support bars. However, the actual daily total of iron passed through the furnace varies from 14,339 lb. to 15,788 lb. This variation is to be expected due to jobbing work. For the same reason the difference in energy consumption per day can be accounted for, this variation being between the limits of 1,479 and 1,345 kw.-hr. per day. This excludes, of course, the first day of operation, when the energy necessary to preheat the cold furnace raised the daily consumption to 1,577 kw.-hr.

The furnace was operated for enameling purposes a total of 77 hours out of the possible 144 hours, or 53.5 per cent of the total time. This indicates that the furnace is being operated satisfactorily with respect to time in operation.

For every pound of material fired in the furnace, it was necessary to heat 0.646 lb. of support bars. Here is an item which, if improved, would show a considerable saving over a year's operation, as every pound of iron which enters the furnace requires a definite amount of energy to heat it. For example, in one load, when the weight of the support bars was 0.127 lb. per pound of charge, it was possible to secure an economy of 10.02 lb. of charge fired per kilowatt-hour, while on another run the support bars, weighing 0.894 lb. per pound of charge, an economy of only 7.02 lb. of charge fired per kilowatt-hour was obtained.

There are, of course, marked limitations in the reduction of the ratio of weight of support bars to weight of charge. Due to the shape and weight of certain pieces, this ratio will be inherently large. However, it is to be remembered that any reduction in unnecessary iron placed in the furnace would be most economical.

		Lb.
Total Weights:		
Supports		35,142.25
Charge		54,406.55
Total		89,548.8
Total consumption—8,657.58 kw.-hr.		
Pounds per kilowatt-hour:		
Based on total iron in furnace		10.35
Based on total charge only		6.28
	Hr.	Min.
Total time of operating furnace	77	03
Rate of production, lb. per minute		11.77
(This figure is based on weight of total charge only and includes preheating periods, loading and unloading periods and idle periods at noon.)		
Maximum demand of furnace, kw.		160
Load factor— $\frac{8,657.58 \text{ kw.-hr.}}{160 \text{ kw.} \times 77.05 \text{ hr.}}$	=	70 %
Average time of charge in furnace, minutes	=	28.8
Average Weights:		Lb.
Support bars per operation	=	264
Charge per operation	=	408
Fired	=	2.58
Heaviest piece fired	=	50
Lightest piece fired	=	0.375
Pounds of support used per pound of charge	=	0.646
Total Number:		
Pieces fired	=	21,056
Operations	=	133

Engineers Make Noise a Joint Problem

Electrical engineers are conscious of their civic responsibility in meeting the public demand for noise mitigation, but find several impediments to a rapid discharge of the duty. These difficulties seem to lie in three directions—measurement, design and mitigation. All these phases of the subject were discussed at the recent A.I.E.E. district meeting at Rochester, electrical and mechanical engineers of the utility and manufacturing branches of the industry being joined by physicists and acoustical engineers in a joint effort to advance the art in all these respects.

No more significant index of the state of the accoustical measurement art can be given than the apparent need at the meeting for the posting of a chart of prevailing scales of sound measurement and the request of the presiding officer, P. L. Alger, that each author and each discussor announce, before proceeding, just which scale his meters and data followed. Some of these scales were built on the decibel system, others were linear or arbitrary; further discrepancies are noted in the varying magnitudes assigned to the starting point of the scale and the value corresponding to a "just painful" intensity of sound. It is evident that noise mitigation, in order to make progress, must depend on the provision of a standard scale which must also have some fixed point of departure if it incorporates the decibel feature for expressing successive magnitudes. The discussion seemed to favor the decibel scaling and the adoption of some appropriate magnitude of pressure in dynes per square centimeter (for example, 0.001 dynes) as representing the arbitrary threshold value of noise for the average ear at 1,000 cycles per second. The other societies interested are to continue this investigation with the expectation that such standardization can be arrived at in a reasonable time. Until that can be done it must be admitted that the art of noise and sound measurement is at the stage where illumination was 30 or 40 years ago.

Meters to measure sounds and noises, in addition to conforming to the prevailing scale of units, are needed to perform two somewhat different functions. One of these is to evaluate noise in terms of its auditory disagreeableness. The other is to analyze the composition of noise more or less independently of the synthesizing characteristics of the human ear. The detrimental aspect of noise rests primarily in a vague property of disagreeableness, unmeasurable except in terms of the components unless the instrument is weighted in its response to imitate the average ear's selective behavior. Further than that the electrical engineer is especially interested in having a meter which would be highly selective in separating adjacent harmonics of the fundamental 60-cycle frequency, which is their principal encounter. Various meters were described and demonstrated at the session.

The group of papers dealing with the origination of noise in electrical machinery and apparatus generally attributed to the stator most of the noise from rotating machines. Pole frequency establishes a chain of components associated with double the line frequency; the tooth spacing contributes the bulk of the higher frequency components. Air gap forces are large determining factors and it is not strange that apparatus is prone to create noise from this source when it is recognized that common flux densities give pulls of the order of 45 lb. per square inch. Both rotating machines and regulators disclose on analysis a tendency to create elliptical distortions and vibrations which tend to predispose the direction of propagation of the resulting noise. In most cases the mitigation hinges upon effecting the structural design of the machine in such manner that there is minimized tendency to have resonance between the mechanical structure and the electrical or magnetic impulse. Transformers seem to have a tendency to emit more noise at no load than when loaded.

Mitigation of noise in existing installations is much more a matter of isolation than of absorption. Mounting on elastic supports and inclosure of apparatus both have this for their objective. Consequently the elastic mounting is desired to have a minimum of damping and of progressive compressibility. The advocates of rubber cite its superiority in these respects, but several reported successful use of cork. Isolation of the lower frequency components seems to solve most of the difficulty, the higher frequency elements apparently disappearing automatically in the process. In the case of belted machinery it is essential to provide a mounting rigid enough to insure stable belt behavior, otherwise cyclic fluctuation of belt speeds will introduce new contributions to machine vibration.

Incidentally, the study of existing noise in stations and substations reveals the fact that reflections and other factors tend to produce considerable modification of the sound distribution along any particular radius from the seat of its origin. It is therefore desirable to make many measurements, much as was necessary in connection with the determination of spherical candlepower from luminous sources. The same phenomena raise the question in connection with the calibration of the instruments—shall they be calibrated in the open where reflections and spurious distribution are at a minimum or shall they be calibrated in baffled rooms to exclude the effect of reflections?

Isolation of noise by inclosure gives rise to two diffi-

Prevailing Noise Scales Must Soon Give Way to a Single Standard

	1	2	3	4	5	6	7	8
Name	Pressure Dynes per Sq.Cm.	Intensity	Sensation Level Loudness	Noise Level	Sound Level		Masking	Deafening
Scale	Linear	Decibel	Decibel	Decibel	Decibel	Decibel	Decibel	Arbitrary
Reference point dynes/cm²	0	6.5	Threshold	Threshold	0.001	0.01	Threshold	Threshold
Reference frequency		1,000	700	Street noise	1,000	1,000	Warble	Buzz
Weighted	No	Yes	Yes	Yes	Yes	Yes	Uses ear	Uses ear
Examples								
Just painful	2,500	50	130	130	125	105	115	100
Just audible	0.0005	—80	0	0	—5	—25	0	0
Average residence	0.05	—45	32	35	30	10	20	20

Notes on the above scales. 1. Tremendous range, no relation to audibility, ignores frequency weighting of ear. 2. Weighted for ear characteristics. 4. Mixed standard but of prescribed composition. 7, 8. Based on screening effect of warble or buzz, differential or incremental in nature.

culties. - In the first instance inclosure accentuates the difficulties of ventilation, so much so that ventilation and noise mitigation are likely to exist as companion problems in much of future design. In addition the inclosure itself, unless properly designed, is likely to add large surface areas to those from which sounds can emanate. The use of canvas joints in air ducts has been found to curtail the transmission of noise from the machine inclosure to the vent and the building structure.

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Guessing Ground Resistances Is a Risky Procedure

By S. W. BORDEN
Manager Borden Electric Company, Newark, N. J.

Some tests were made recently on a steel tower line located where the earth for some depth consists of sand and gravel. The four tower legs, which form a 15-ft. square, are buried directly in the ground and each tower carries two three-phase, 66-kv. circuits, both of which were in operation at the time of the tests. Each tower carried two ground wires suspended from the crossarms by means of a U-bolt, a separable galvanized iron link and cable clamp, no provision being made for connecting the ground wire to the tower except by way of the link.

One of the suspensions was removed and tested. When under no strain, except its own weight, the link showed a very unstable resistance, running sometimes in excess of 50 ohms, and when placed under a strain of about 100 lb. the resistance was never less than 5 ohms. A large part of the total resistance was made up of the contact with the link at the top and bottom.

The resistance to ground for one of the ground wires was found to be 8 ohms. The ground wire is an aluminum steel core cable of 195,000 cm. The average resistance of the towers along the line runs about 40 ohms per tower, the towers being approximately five to the mile, with the nearest substation about 30 miles away.

With both ground wires disconnected, the tower in question measured 25 ohms and with both ground wires connected, via the suspension links, the tower tested 16 ohms, indicating a large amount of resistance in the suspension links. The low resistance of 25 ohms for this particular tower was obtained by means of additional electrodes spaced half way between the tower legs on all four sides and some additional electrodes also, all of which were connected to the tower. The electrodes were treated with salt.

A pair of standard test rods $\frac{1}{2}$ in. in diameter and 4 ft. long were used as reference electrodes. The resistance of the return current electrode was found to be 2,200 ohms and the resistance of the potential probe 6,450 ohms. The difference in these two electrodes shows how impossible it is to "guess" at resistance values and their very high values indicate the danger of attempting to make ground tests without a full knowledge of the reference electrode resistances.

Some tests recently conducted on the premises of a large chemical plant disclosed the following values: A connection was made to a No. 0000 ground wire running from some transformer cases to the general water piping system supplying the plant and the resistance was found to be zero, the measurement probably being correct within one- or two-hundredths of an ohm. While zero is a frequent "guess" for a water supply system, this is the first case in which the author has ever found an actual zero resistance ground. A $\frac{1}{2}$-in. test rod 4 ft. in the ground measured $\frac{3}{10}$ ohm and 6 in. in the ground measured 5 ohms. These values resulted from the fact that the entire property is filled in for a depth of several feet with slag and refuse from the chemical processes carried at the plant and what would generally be taken to be earth or soil is, in fact, practically a solid plate of very low-resistance materials.

It is interesting to note that the development of ground testing meters has reached a point where it was possible to make all of the foregoing measurements, ranging from a few hundredths of an ohm to more than 6,000 ohms, with a single meter giving direct readings of the resistance values without any calculations or corrections for the high resistance test probe involved in some of the tests.

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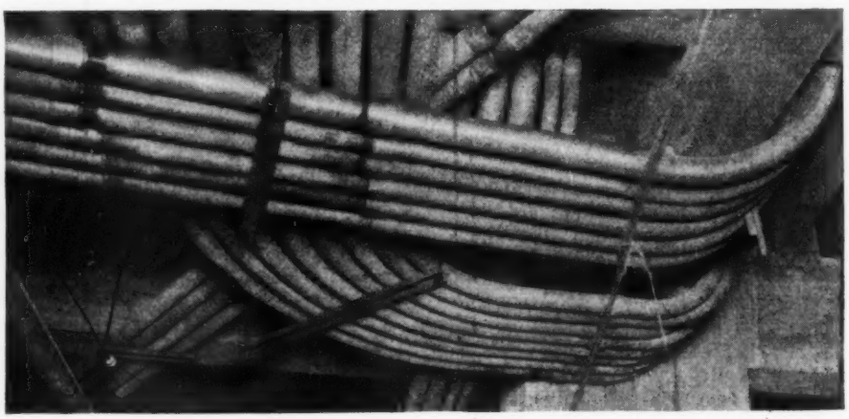
Nested Conduits Conserve Space for Ventilating Lines

Ceiling height in corridors of tall office buildings is usually reduced by ventilating ducts and pipe runs for various building services. To conserve as much as possible of this height for other necessary services it is necessary to design the electrical conduit runs so that the bends shall not consume much headroom and crossings be compacted to utilize fully all available channels between floor beams. The illustration was supplied by James A. Walsh, engineer L. K. Comstock & Company, and shows an intricate nesting job in the Empire State building in New York City.

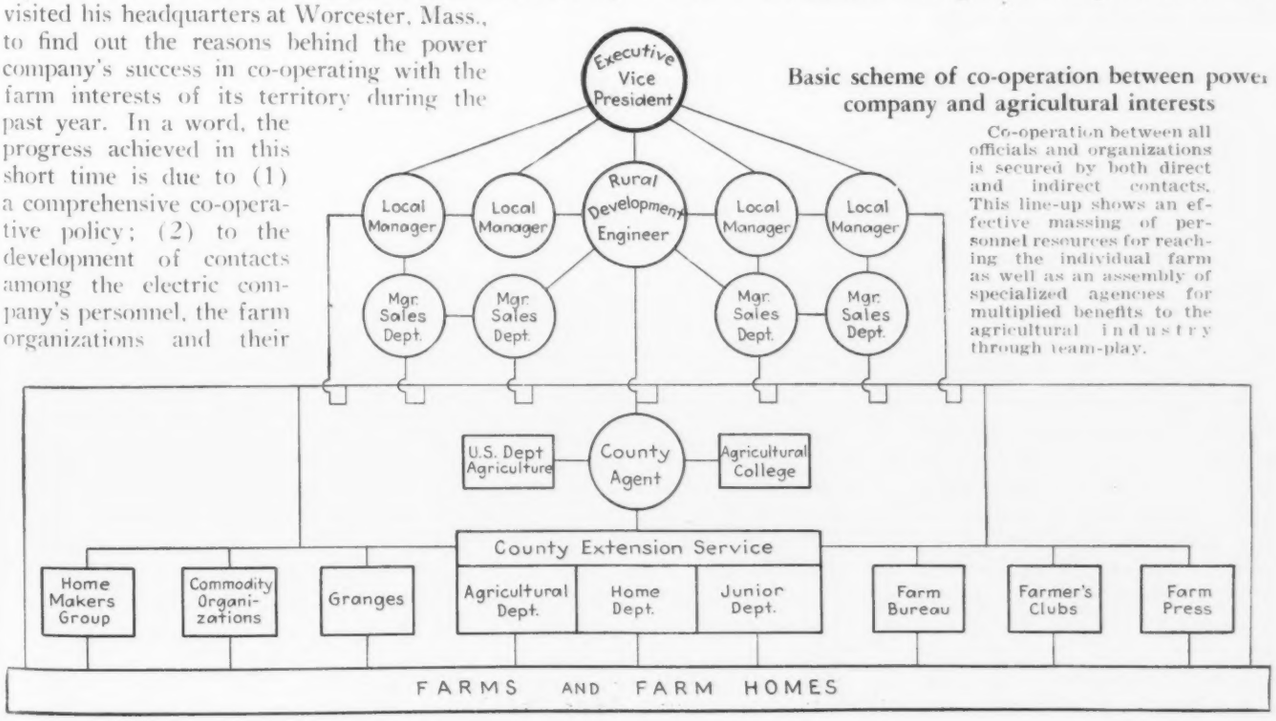


Organizing to Aid Rural Development

Through close co-operation between the electric company and representatives of the farming industry the operating subsidiaries of the New England Power Association have added more than 3,800 rural customers to their lines in the past two years. The basic organization of this work is illustrated in this article

"LACK of systematic handling of inter-industry problems has delayed progress wherever haphazard methods have been allowed to control the situation. Rural electrical development has long worked under precisely this handicap in many parts of the country, but better days are ahead," declared F. L. Rimbach of the New England Power Association to a representative of the ELECTRICAL WORLD who recently visited his headquarters at Worcester, Mass., to find out the reasons behind the power company's success in co-operating with the farm interests of its territory during the past year. In a word, the progress achieved in this short time is due to (1) a comprehensive co-operative policy; (2) to the development of contacts among the electric company's personnel, the farm organizations and their representatives, and (3) to systematizing all relations between the power company and the rural field.

"During 1929 the New England Power Association began a constructive rural service program," said Mr. Rimbach, "and from the beginning every effort was made to co-operate with existing organized bodies such as the state Farm Bureau Federation, the County Agricultural Agents and the agricultural colleges. The Power Association's work headed up in the person of a rural development engineer (who happened to be myself). The co-operation of our local managers and sales staffs, of our engineering forces, rate experts and indeed the whole utility staff was pledged to help along farm electrification on sound economic lines. Besides carrying on our field work in direct contact with the farm organizations we have compared notes with other power companies and have sought to co-ordinate our efforts with the best thought of the agricultural and power industries in establishing profitable service to the farmer and increasing our own business. Three demonstration farms have been established in Worcester County, where equipment is tested and costs of operation and adaptability to New England conditions are determined. Supervision is maintained through the co-operation of the



Basic scheme of co-operation between power company and agricultural interests

Co-operation between all officials and organizations is secured by both direct and indirect contacts. This line-up shows an effective massing of personnel resources for reaching the individual farm as well as an assembly of specialized agencies for multiplied benefits to the agricultural industry through team-play.

Farm Bureau, the electric company, County Extension Service and the Massachusetts Agricultural College. Dairying, fruit storage and poultry raising are featured on these farms."

Typical organization plan

The New England Power Association's set-up for rural development ties into the farm interests through the county agent, who is a territorial guide, philosopher and friend of the local farm industry in all its ramifications. In many parts of the country a surprising lack of understanding exists about the mutual work and interests of the county agents and power companies. Some utility men apparently do not know what a county agent is. As the chart indicates, he is a key man in the agricultural industry in close and constant touch with the governmental department and collegiate institutions most interested in farm progress. He supervises much important educational and welfare work in his territory and is authoritatively acquainted with the problems of individual farms.

"Some county agents do not as yet realize the good they can accomplish for their farmers by co-operating with the power man," said Mr. Rimbach. "The farmers need electricity and the utilities want to sell it. Active co-operation between the utilities and these agents builds up farmers' appreciation of the usefulness of electricity and makes possible rural extensions that could otherwise not be built because of small usage of electricity. Nothing is to be gained by a utility representative trying to make farmers believe he is playing Santa Claus, as it is only through the generous use of electricity that lines can be profitably extended into the rural areas. I have had no difficulty in making contacts with all agricultural leaders and find that they have a frank appreciation of the need for co-operative work.

"The extension of the use of electricity on farms cannot be done by the agricultural men alone nor by the electric companies alone, but through the co-operation of these two groups progress can be made.

"The home demonstration agents of the County Extension Service form another group whose acquaintance is most valuable to the rural power man. They are as much interested in seeing the farm wife use helpful electrical appliances in her home as is the power man.

"It is hard to find a family in a county that the county agent and his staff do not know, including their conditions and needs. It is therefore the most logical step in the world that the power man should become acquainted with the people who best know the farm families in his territory."

Power and farm groups coming closer

Mr. Rimbach pointed out that both G. F. E. Story, county agent of Worcester County, and he have observed a wholesome change in the atitude of both power and agricultural interests toward electric service on the farm within the past year. Many power men have believed that efforts to build the farm power load would avail them little; likewise, many agricultural leaders did not seem to realize the importance of applying electricity to farming. At Farm Bureau meetings questions asked about the power company revealed a decided lack of understanding of methods, costs, etc. A joint committee of the New England Power Association and the Worcester County Farm Bureau was created to iron out some of these misunderstandings. Each group has three members and Mr. Story is the seventh member and chairman. The meetings are entirely informal and frank, with the result that confidence and understanding have been established between the groups. No difficulties have arisen which the committee has not been able to straighten out. "The satisfaction which has come to our company," said Mr. Rimbach, "from having a joint committee capable of seeing all sides of a problem leads me to believe that power companies throughout the country will find in this plan a helpful aid in carrying out rural electrification on a constructive basis. The county agent and I are in almost daily conference in regard to the various problems arising in the field, and in such contacts real headway is being made toward the solution of rural electrification on our system."

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A 270,100-Hp. Italian Hydro Plant

Notable among the features of the large hydro-electric power station for general energy production and railroad supply purposes recently constructed by the Societa Idroelettrica dell' Isarco at Cardano, a village about 3 miles from Bolzano, in northern Italy, are the large plant capacity, welded penstock construction and distance from the load center served. This station operates under a total head of about 541 ft. with a present installed capacity of 270,100 hp.

Water from the Isarco River is collected by means of a large dam and forebay at Ponte all'Isarco, whence it passes through a 10-mile tunnel to the surge tank and thence through the penstocks to the power house. (See page 1164 of this issue.) At the dam three oil-pressure-operated floodgates, each 49 ft. 2 in. wide, are provided for the diversion of the water, together with a 13-ft. gravel-discharging gate. The 10-mile tunnel which conveys the water to the power station has a slope of 0.075 per cent, allowing a water flow of approximately 11,000 gal. per second.

Six penstocks have been provided. Five of them—one for each turbine—have a length of about 1,082 ft., the static head being approximately 527 ft. The upper section of these five pipes is constructed of riveted steel plate, while the lower section consists of banded pipes; i.e., lap-welded pipes reinforced by rolled seamless rings shrunk on when hot. These are said to be among the largest inside diameter (8-ft. 2-in.) banded pipes in the world. The sixth pipe, which supplies the water for the turbo-generator set supplying the power for the operation of the electric trains for the Brenner Railway, has an inside diameter of 6 ft. 6¾ in. and is throughout its entire length of riveted construction. The pipes, where the wall thickness is unable to withstand the stress induced by the weight itself, together with that of the water and the possible internal vacuum, are reinforced by external iron rings.

The power house contains eight generating units, all of Italian construction. Five of the turbines are of the Francis vertical shaft type, each developing 45,000 hp.

at 242-250 r.p.m.; two 500-hp. Pelton turbines, working at 500 r.p.m., supply the power required for the station service, while three 14,700-hp., 250-r.p.m. Pelton turbines are used for the supply of power for the Brenner Railway.

The power generated by the five large alternators is stepped up at an outdoor transforming station adjoining the power house at 220,000 volts, at which pressure it is transmitted by a line, 146 miles in length, belonging to the Societa Idroelettrica Piemonte to Cislago, near Milan, where it is again stepped down for distribution through the mains of the Piemonte company.

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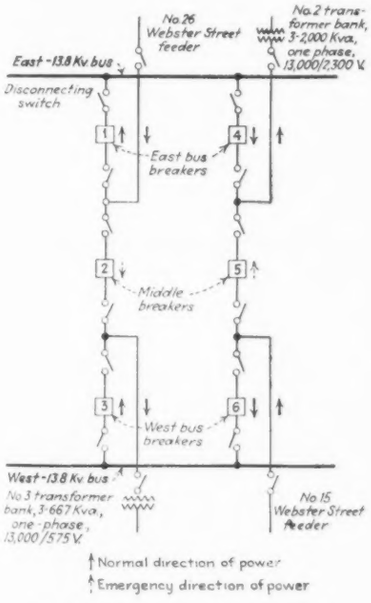
Clearing Substation Buses with Lines in Service

The so-called "1.5-circuit-breaker-per-line" scheme used on the transmission circuits of the New England Power Association has recently been adapted to 13.8-kv. substation practice on the subsidiary system of the Worcester Electric Light Company, with resulting high flexibility. The substation is supplied by six 13.8-kv. lines and delivers energy via fifteen 2,300-volt outgoing feeders, four 575-volt feeders and eleven street-lighting circuits.



Both buses may be killed without interrupting service from incoming feeders through step-down transformers

Energy normally received from the 13.8-kv. lines and stepped down to either 2,300 or 575 volts is distributed from either bus through the bus breakers. Both buses may be cleared without interrupting line and transformer connections by direct switching through the middle breakers. This arrangement also permits connection of a feeder or transformer circuit to either bus through a middle breaker in case the corresponding bus breaker has to be taken out of service.

With 13.8-kv. energy fed to the buses as indicated by arrows in the diagram, breakers 1 and 6 energize the each and west bus respectively. Power is distributed from buses through breakers 3 and 4. The middle breakers 2 and 5 are normally open. To clear buses, breakers 2 and 5 are closed and the bus breakers 1, 3, 4 and 5 are opened, the transformers being fed directly from the incoming lines. To take breaker 3 out of service breakers 1 and 2 are closed and transformer bank No. 3 is fed from the east bus.

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Radio Brings One Utility $1,310,000 Energy Revenue

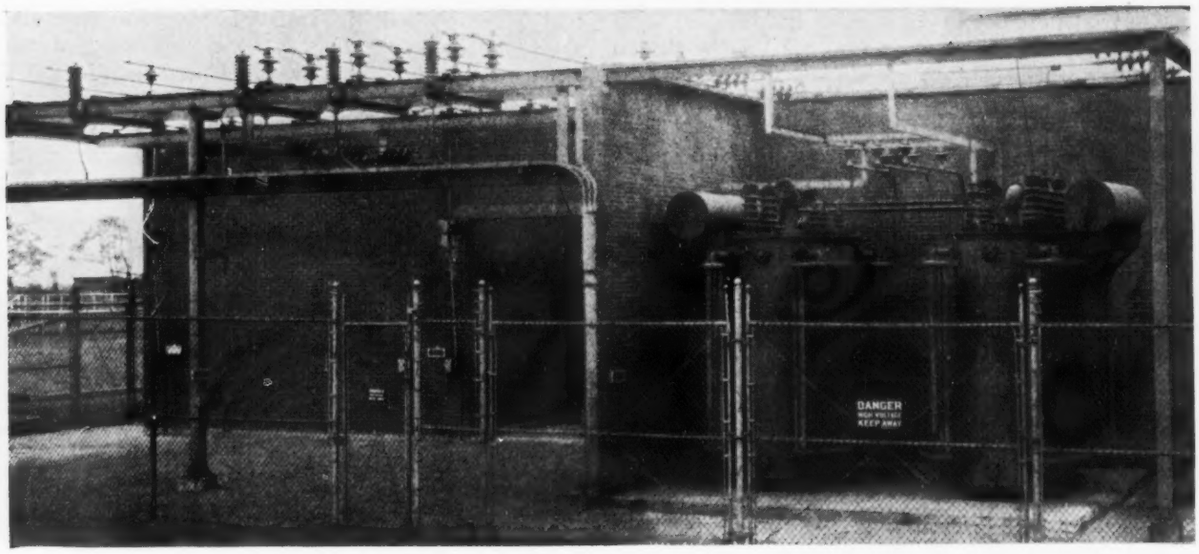
Various attempts have been made to estimate the revenue received by power companies from radio sets. A check recently made by a large utility revealed the fact that it derived $1,310,000 in revenue from 150,000 radio receivers. The method of arriving at this figure is of interest.

According to the market analysis department of *Radio Retailing*, there were 636,000 radio receivers in the particular state on January 1, 1929. Of these, 390,000 were in utility territory. The company has approximately 450,000 lighting meters out of a total on all systems in the territory of 990,000, or 45.5 per cent. Assuming equal distribution, the company then served 177,000 radio sets as of January 1, 1929. Figures compiled by a large metropolitan daily based on personal calls on 600 homes showed that 304 owned radios, of which 262, or 86 per cent, were all electric or battery operated. Thus 86 per cent of 177,000, or about 150,000 radios, were using the utility's service.

The Radio and Music Trades Association of the principal city in the territory estimates radio sets operate on an average of five hours per day. This figure was checked closely by the newspaper, which found 295 families operated their sets an average of 5.22 hours per day per set. Due to the great variety of makes and models of sets, it is impossible to get an accurate average energy demand, but considering twenty models including seven popular makes, the average demand was found to be 125 watts per set. Since sets in 1928 were less modern than those today, an average demand of 100 watts was used. Average rate earned by domestic customers on this system is 4.8 cents per kilowatt-hour. Thus the revenue from radio per year would be 100 watts $\times$ 5 hours $\times$ 365 days $\times$ 0.000048, or $8.75 approximately. This multiplied by 150,000 gives the surprising figure of $1,310,000 annual revenue. This is an average of $2.90 per year for each and every one of the company's 450,000 lighting meters.

Any utility that wishes to assume radio saturation and average rate to be about the same as in this case can apply a rule-of-thumb method of arriving at the revenue it derives from radio by multiplying the number of its lighting meters by $2.90. Aside from the intriguing size of this figure of $1,310,000, it has a significance that the power company cannot overlook. Radio interference is a matter of growing importance and most utilities are now co-operating fully in mitigating this evil.

Considering the large amount of revenue derived from radio receivers the power company is well justified in spending a small part of the revenue in promoting better public relations through interference elimination, even even if is as little as 1 per cent.



Two of the four 3,750-kva., 23,000/6,600-volt, three-phase, oil-insulated, self-cooled transformers which furnish power for the operation of the new A. M. Byers Company wrought iron plant

Steel Mill Electrification

Late practice in power supply and distribution applied to new mill of A. M. Byers Company.

Uses both alternating and direct current supply and equipment.

Power purchased.

By STRICKLAND KNEASS

Chief Engineer A. M. Byers Company

LOCATED near Ambridge, Pa., the new plant of the A. M. Byers Company has an estimated ultimate capacity of approximately 45,000 tons of wrought-iron products per month, made by a recently developed and perfected mechanical process. Practically all of the auxiliary and main machines are electrically operated, the total capacity of the motor drives being about 35,000 hp. The process, from the initial melting of the iron in the cupolas to the rolling into blooms by the 40-in. blooming mill, is a continuous one, and interruptions in operation, if of more than a few minutes' duration, will result in the loss of the material being processed. It is thus essential that the electrical power service be reliable and that the distribution system be flexible, so that at least the most essential services can be maintained under any abnormal or emergency condition. The equipment and circuit arrangements of the distribution system were selected to provide this flexibility and reliability.

Power is purchased from the Duquesne Light Company and is brought to the steel plant substation over a double-circuit, 23,000-volt, three-phase, 60-cycle transmission "ring" or loop. Each circuit feeds two 3,750-kva., three-phase transformers, stepping down to the distribution system pressure of 6,600 volts. The 6,600-volt bus at the main power transformer substation is in two separate sections, each fed from the two transformers in parallel and each feeding underground cable circuits to the consuming substation buses at the blooming mill motor room and the plate and skelp mills motor room. A tie line connects the two motor rooms and permits power flow in either direction, so that operation may be continued with any two feeders out of service. Over-current relays at the transformer substation and reverse power relays at the consuming substations act to clear any fault which may develop on the tie or feeder cables or on the substation buses.

It will be noted that 250-volt direct-current power is provided at the blooming mill motor room by two 1,000-kw. synchronous motor-generator sets and at the plate and skelp mills motor room by a third 1,000-kw. set. Similarly, 220-volt alternating-current power is provided at each motor room by a 750-kva. transformer

bank. Tie circuits of 250-volt d.c. and 220-volt a.c. connect the two motor rooms, so that auxiliary power service is available throughout the mill even though the main 6,600-volt power bus may be out of service at one or the other of the motor rooms. Likewise, the river pump house is fed from each of the motor rooms, so that water supply may be maintained with service interrupted at either motor room. Thus a fault at either motor room may cause the shutdown of the main machines in that substation, interrupting the operation of the main rolling mill equipment, but auxiliary power service is not interrupted, and cranes, conveyors, etc., are available to remove material in process, thus preventing serious damage to the equipment.

It is essential that power be available at all times for the operation of the motors which tilt the bessemer vessels in which the iron is refined. To provide this reliability of 250-volt d.c. service these few motors are automatically transferred to the oversize control storage battery whenever there may be a complete power interruption.

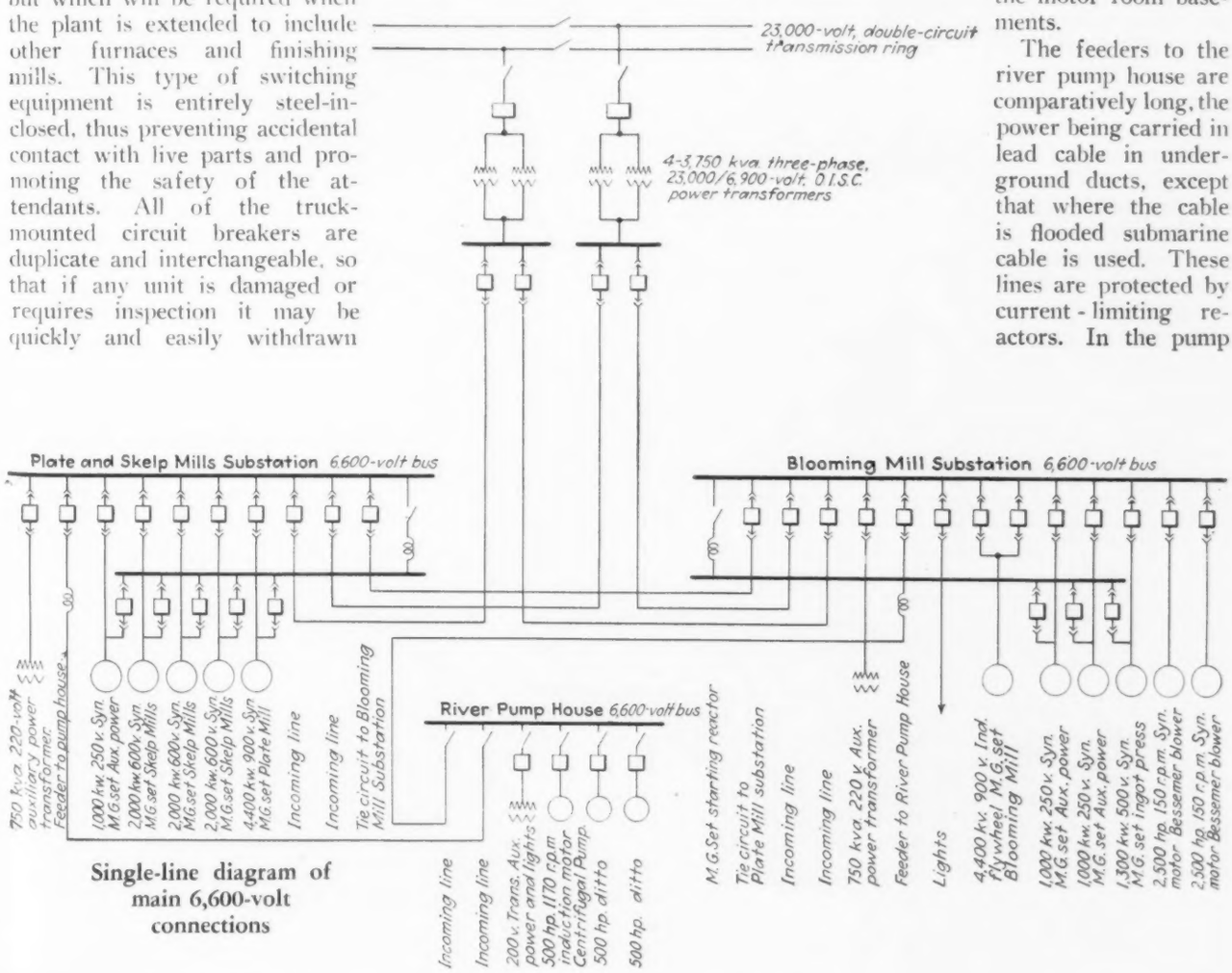
The main 6,600-volt circuits at the transformer substation and in both mill motor rooms are controlled by Westinghouse type B-32, 1,200-amp., 15,000-volt, truck-mounted oil circuit breakers. These circuit breakers are of the modern single-tank construction and have a rated interrupting capacity of 350,000 kva., which is greater than the present maximum short-circuit kva., but which will be required when the plant is extended to include other furnaces and finishing mills. This type of switching equipment is entirely steel-inclosed, thus preventing accidental contact with live parts and promoting the safety of the attendants. All of the truck-mounted circuit breakers are duplicate and interchangeable, so that if any unit is damaged or requires inspection it may be quickly and easily withdrawn and replaced by a spare unit upon short notice.

A unique feature of the installations at the two motor rooms is the location of meter and relay panels on a 30-in. high superstructure above the main circuit breaker structure. The meters, control and protective relays, test terminals, etc., are mounted on the front hinged doors, and field contactors and other accessories are mounted within the superstructure. This construction has a number of advantages: Separate control and metering panels are eliminated, thus effecting a considerable saving in floor space; connections between the circuit breaker housings and the metering and relay panels are permanently made at the factory, thus greatly reducing the cost and time of installation; the manufacturer can build the combined circuit breaker structure and superstructure for approximately the same price as the circuit breaker structure and separate control and metering panels, so that there is the direct saving in cost represented by the conduit and control cables usually required; the meters and relays are made readily accessible by a short, wheeled stepladder.

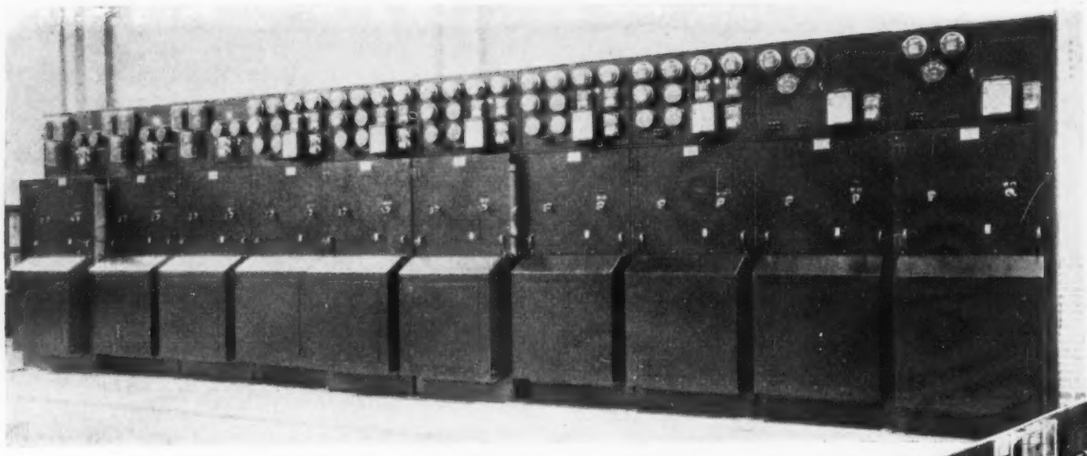
Starting bus for synchronous motors

Synchronous motor-generator sets at each motor room are started at reduced voltage from a starting bus fed through current-limiting starting reactors from the main bus. The starting oil circuit breakers are also truck mounted, type B-2, non-automatic, and are located in the motor room basements.

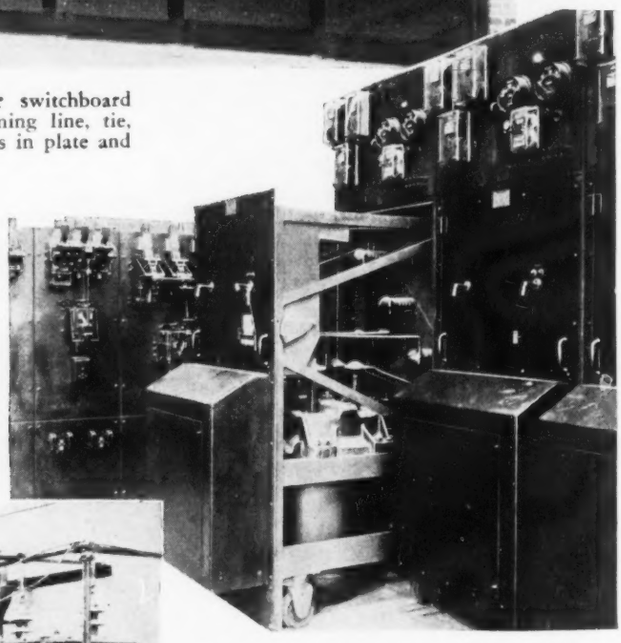
The feeders to the river pump house are comparatively long, the power being carried in lead cable in underground ducts, except that where the cable is flooded submarine cable is used. These lines are protected by current-limiting reactors. In the pump


23,000-volt, double-circuit transmission ring
4-3,750 kva. three-phase, 23,000/6,900-volt, O.I.S.C. power transformers
Plate and Skelp Mills Substation 6,600-volt bus
Blooming Mill Substation 6,600-volt bus
River Pump House 6,600-volt bus
750 kva. 220-volt auxiliary power transformer
Feeder to pump house
1,000 kw. 250 v. Syn. M.G. set Aux. power
2,000 kw. 600 v. Syn. M.G. set Skelp Mills
2,000 kw. 600 v. Syn. M.G. set Skelp Mills
2,000 kw. 600 v. Syn. M.G. set Skelp Mills
4,400 kw. 900 v. Syn. M.G. set Plate Mill
Incoming line
Incoming line
Tie circuit to Blooming Mill Substation
Incoming line
Incoming line
200 v. Trans. Aux. power and lights
500 hp. 1170 r.p.m. induction motor Centrifugal Pump.
500 hp. ditto
500 hp. ditto
M.G. Set starting reactor
Tie circuit to Plate Mill substation
Incoming line
Incoming line
750 kva. 220 v. Aux. power transformer
Feeder to River Pump House
Lights
4,400 kv. 900 v. Ind. Flywheel M.G. set Blooming Mill
1,000 kw. 250 v. Syn. M.G. set Aux. power
1,000 kw. 250 v. Syn. M.G. set Aux. power
1,300 kw. 500 v. Syn. M.G. set ingot press
2,500 hp. 150 r.p.m. Syn. motor Bessemer blower
2,500 hp. 150 r.p.m. Syn. motor Bessemer blower

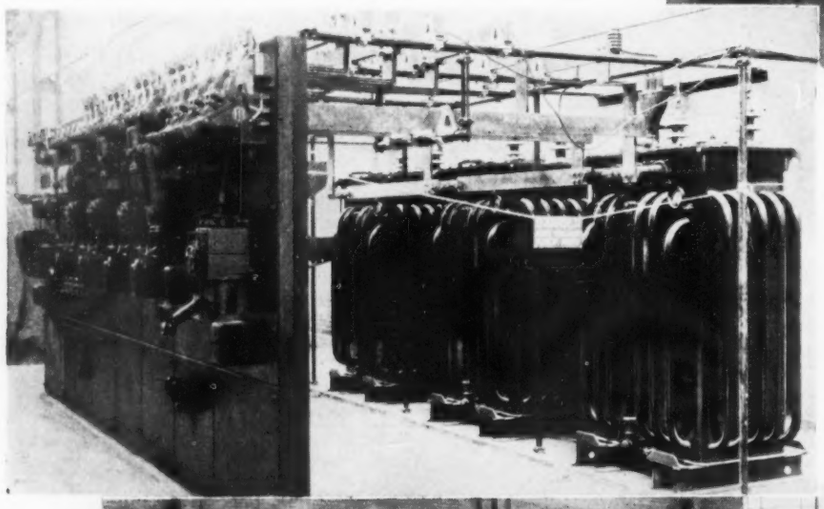
Single-line diagram of main 6,600-volt connections



Ten-panel truck type oil circuit breaker switchboard structure to control main 6,600-volt incoming line, tie, motor-generator set and transformer circuits in plate and skelp mills motor room

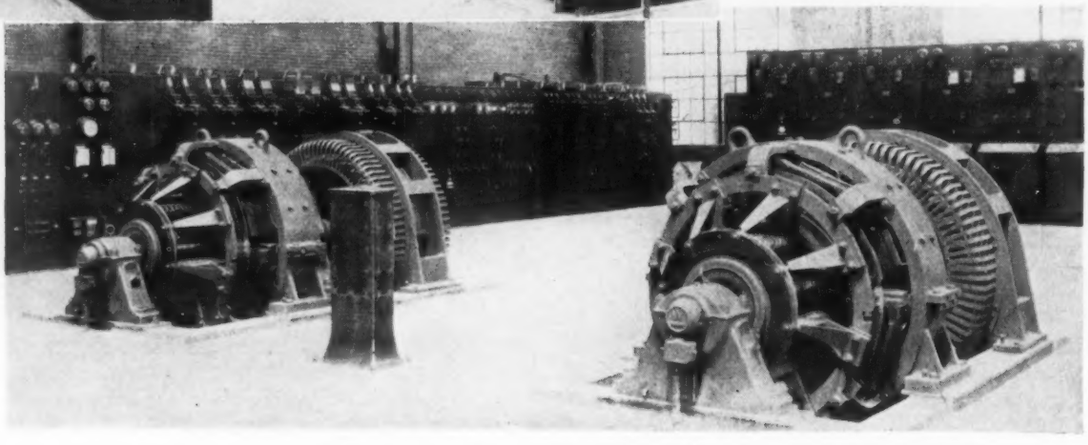


750-kva., 6,600/220-volt auxiliary power transformer bank and 220-volt distribution switchboard in plate and skelp mills motor room. A similar substation is installed in blooming mill motor room



Truck circuit breaker switchboard in blooming mill motor room, showing construction of partially withdrawn B-32 truck circuit breaker and meter and relay panels above circuit breaker structure

1,000-kw., 250-volt d.c., 6,600-volt, three-phase, 60-cycle, 80 per cent power factor, synchronous motor-generator sets in blooming mill motor room, supplying auxiliary power



house the service transformers and induction pump motors are controlled by Westinghouse type B-16 oil circuit breakers, mounted in a welded angle frame structure. To conserve floor space, the meters, relays and control equipment are mounted on panels above the circuit breaker frame structure.

In laying out the power distribution system for this new plant the principal thought was to provide reliability of essential power service and flexibility for ease of control and for the addition of circuits as the plant may be enlarged.

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Power Consumption in Chemical Processes

Various electrolytic and electrothermic factors affect the efficiency of such processes as raising to temperature in furnaces, heat of formation, primary product reacting with bodies at the electrode, radiation, current leaks and short circuits. Owing to the above the power demands are often far removed from the theoretically simple value computed from the well-known Faraday law. The following tabulation, taken from reliable sources, gives an idea of power consumption in various electrochemical processes:

Kilowatt-Hours of Electrolytic Processes

Material	Kilowatt-Hours per Ton
Aluminum	25,000 to 30,000
Cadmium	1,600 to 2,500
Caustic soda, 1.1 tons Chlorine, 1 ton	2,600 to 3,200
Chloral	13,000
Cerium	18,000
Copper refining	180 to 300
Copper leaching	2,000 to 2,800
Gold	300
Iodoform	1,500
Iron (refined)	3,600
Lead (refined)	80 to 100
Lead (basic arsenate)	450
Lead (white)	250 to 300
Magnesium	17,000 to 27,000
Nickel (extracted)	3,200 to 3,800
Nickel (refining)	1,100
Para-amina-phenol	18,000 to 20,000
Potassium chlorate	6,400
Silver	600 to 800
Sodium	15,000
Sodium chlorate	7,200
Tin refining	1,800
Zinc refining	2,800 to 3,100
Hydrogen, 7 cu.ft. Oxygen, 3.5 cu.ft.	per kilowatt-hour

Kilowatt-Hours of Electrothermic Processes

Material	Kilowatt-Hours per Ton
Alundum	2,000 to 3,000
Barium oxide	1,200
Brass melting	180 to 340
Calcium carbide	2,500 to 3,000
Calcium cyanamid	4,000
Carborundum	7,600 to 9,000
Carbon bisulphide	850 to 1,100
Ferro-chromium, 70 per cent	8,000
Ferro-manganese, 70 to 80 per cent	4,500 to 5,000
Ferro-molybdenum, 60 per cent	8,000
Ferro-molybdenum, 70 per cent	9,000
Ferro-nickel, 55 per cent	12,000
Ferro-silicon, 50 per cent	4,000 to 6,000
Ferro-silicon, 75 per cent	10,000 to 14,000
Ferro-tungsten, 70 per cent	6,000 to 7,500
Ferro-uranium, 40 per cent	8,000
Ferro-vanadium, 35 per cent	7,000
Graphite	3,000
Pig iron	2,000 to 2,700
Synthetic iron	650 to 800
Phosphorus	11,000 to 12,000

The majority of the figures given are taken from actual operating data as supplied by Herbert Speight, general engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

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GOOD-WILL SERIES

Precautions in Setting Poles*

By H. A. MARTIN

Chief Engineer Peoples Light & Power Company

Politeness and consideration of customers is most important in every kind of business. In general, public utility employees recognize this fact better than those in some other industries, but there are other businesses which make courteous consideration of customers a major requirement of employees. One of these is the chain store.

Let us look in upon garrulous, grouchy Grandma Graham as she gets her supply of groceries at the chain store. The clerk comes out and puts the box in the tonneau of her car while she gossips with an acquaintance. At the last minute she sees the packages in the back seat and tells the clerk to move them to the front. In complying with her wish the clerk breaks open and spills a bag of rice into the car. He apologizes, returns to the store and bring her three more pounds of rice than he spilled into her car. Thus, he makes a permanent customer for his company.

When we set poles we must not only strive for low-cost construction but give the customer or property owner the consideration he deserves. Poles should be set so as not to interfere with drives, fire hydrants, building entrances or other features. Where reconstruction is being done in business districts the poles should be set in the rear alleys if economically feasible. This permits better results from street illumination of the "Whiteway" type. Where trees line the streets customers are better pleased if the poles are located on the rear lot line. When poles are set along the street the location should be as near as possible to the property line between the lots. This location facilitates running "services" without interfering with driveways and entrances.

More and more the progressive utility is setting poles "in the easement" on the back property line. Here it is difficult to erect the pole without doing some little damage. We must be careful not to "spill the rice"; in other words, we must not spoil the garden, shrubbery, lawn or outbuildings. In setting poles on the consumer's premises see that all the earth removed is replaced around the pole. If the removed earth would spoil the appearance of a flower bed or the lawn place it on a tarpaulin until it is replaced.

Usually it is not necessary to paint poles, but in some cases this is advisable to avoid criticism. Green paint is often preferable for its looks and long life. Do not try to paint over creosote. If the pole is creosoted, first give the creosote a coat of aluminum paint and then one coat

**One of a series of employee instruction sheets developed by the Peoples Light & Power Company to bring about greater consideration of customers' interests.*

of the color. It takes two coats of color properly to coat a new pole and the aluminum does not cost any more than the color and may be used on any kind of pole and will furnish a good primer for the color coat.

In locating terminal poles for cables great care should be taken to see that they are located in such places that they are not likely to be moved, since it is not easy to move the pipes and cables. Choose the location of the poles with the property owner if he is at home. This will make him realize you consider his interests and will help frequently in getting the location you want. Consult Mr. Graham where possible and leave Mrs. Graham to tend to her rice-boiling, but keep in mind Mrs. Graham's wishes.

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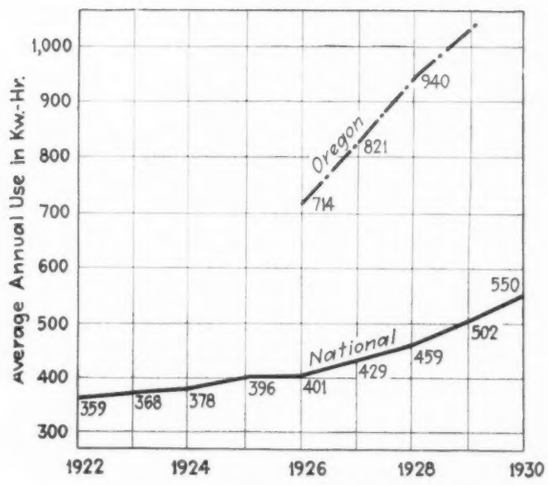
Public Interest Demands Utility Merchandising

Oregon utilities justify merchandising on the grounds that consumers are entitled to maximum usage at minimum rates and furnish evidence proving that only through their activities has this been made possible

WHY electric utilities in Oregon sell electrical appliances and how their activities have benefited the customer as well as the dealer is the subject of a report prepared by the merchandising committee of the Northwest Electric Light and Power Association (Geographic Division, N.E.L.A.). In a lengthy document central stations justify merchandising on the grounds that it is in the public interest.

Utilities are charged with a moral obligation to their customers to afford the greatest possible use of their service at the lowest possible rates. Has this been done in Oregon? The accompanying curves show at a glance that domestic customers of the five major systems* serving 90 per cent of the domestic consumers in Oregon use on an average of 1,130 kw.-hr. per year, for which they receive an average rate of 3.04 cents per kilowatt-hour. This compares with the national average of 550 kw.-hr. per customer at 6.04 cents per kilowatt-hour. What does this mean? It means that pioneering of electric cooking and water heating, primarily, has made it possible for domestic customers in Oregon to utilize almost exactly double the electric energy in the home at half the national average rate. Thus utility companies feel that through aggressive load building they are discharging their obligation to the consumer and that it is almost solely through their efforts that this has been made possible.

The management of any utility, likewise, has an obligation to those whose money is invested in the enterprise to do those things that will stabilize earnings and attract necessary capital for the ever-increasing expansion of the business. The very life of the business depends in a large part on vigorously pushing development from within, and this vigor quite naturally and inevitably has led utility companies into the business of promoting and selling electrical appliances. Particularly is this true in Oregon, where lack of possibilities in the industrial field



Average annual use of electricity per domestic customer

National yearly 1922-1930. Oregon yearly 1926-1930.

have focused attention on the domestic user as the utility's greatest potential market.

Much of the present criticism of utility merchandising has behind it the assumption that there is a fixed volume of demand business in any locality for electrical appliances, which, if the companies were not in the appliance business, would be divided among the complaining trades. Experience shows that this assumption is not well founded. Electrical appliances are not *demand* merchandise. They cannot be sold as groceries are sold. If they are to move in any considerable volume, continuous promotion is necessary. This necessity for continuous promotion of the whole line and the pioneering of newer products is the primary consideration which caused the power companies to engage in the sale of appliances originally.

Independent electrical dealers have never yet demonstrated their willingness to undertake this pioneering, promotion and load-building job. It has been pointed out repeatedly, and dealers readily admit, that under existing discounts on electrical appliances there has not been a sufficient margin of profit in most items to make this required promotional effort economically possible for the dealer from a merchandising standpoint. While this

*Portland General Electric Company, Northwestern Electric Company, Pacific Power & Light Company, Mountain States Power Company and California Oregon Power Company.

situation is regrettable, it is nevertheless a matter over which the power company has no control. Experience has shown that if the business is to develop and produce the results here shown, then the utilities themselves must engage in the sale of appliances and undertake the pioneering and promotion that goes with this activity.

Dealers are not without benefit under the policy pursued by the power companies. Sale of ranges, water heaters, refrigerators, washers, ironers and many other devices, along with the promotion of better lighting in the home, has created a tremendous amount of wiring to make utilization possible. This business has fallen almost entirely into the lap of one class of electrical dealer, the so-called contractor-dealer. Much of this wiring business, particularly that for ranges and water heaters, would never have existed but for the promotional effort of the utility.

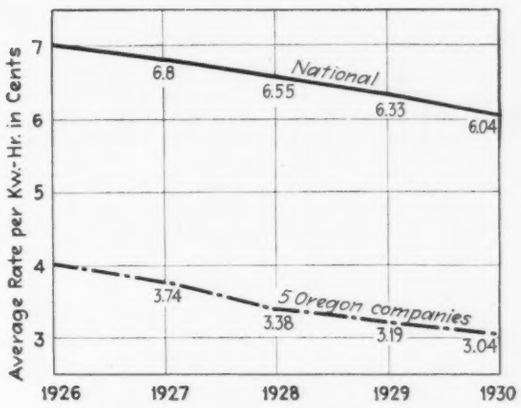
Moreover, the decreasing cost of electric service and the more widespread use of current in the home previously referred to have meant greater opportunity for the dealer to share in the wider appliance market thereby created. Non-electrical dealers likewise have benefited by the sale of other merchandise to customers attracted to their establishments to buy electrical appliances through widespread acceptance of the electrical idea.

Correcting abuses, not legislation, needed

The controversy that has been waged around this whole question of power company merchandising between the utilities, on the one hand, and dealers, on the other, has appeared in varying aspects in different parts of the country, from local squabbles to court cases and proposed state legislation. It is felt, however, that out of the welter of controversy both sides have come to a better understanding of each other's point of view, and to a clearer conception of what the real problem actually is with all its implications. There is a general feeling now on the part of both sides that it is not so much a question of whether utility companies shall or shall not merchandise, as it is a matter of correcting abuses that may have grown up in the companies' merchandising policies and practices.

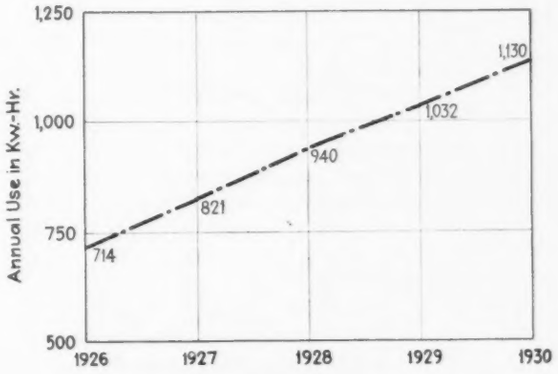
Utilities in Oregon have not overlooked the gravity of the situation, and in recent months various companies have taken steps to adjust their merchandising policies and methods with a view to removing the main causes of dealer complaint that have come to their attention. The companies are not blind to the value of having other dealers aggressively sell electrical appliances. They know that every appliance sold to go on their lines adds kilowatt-hours and revenue. They want the co-operation of the dealers. And dealers, when they fully recognize the value of utility promotional activity, want the co-operation afforded by this activity. After all, it is a job of co-operation. When the magnitude of the market is viewed in proper perspective it is realized that the job is too big for one company or one group. In the method of working out this co-operation lies the hope of the dealer and the utility company alike.

Public interest demands utility merchandising. Legislating utilities out of the merchandising business cannot and will not work to the best interests of the consumer, the utility, nor the dealer.



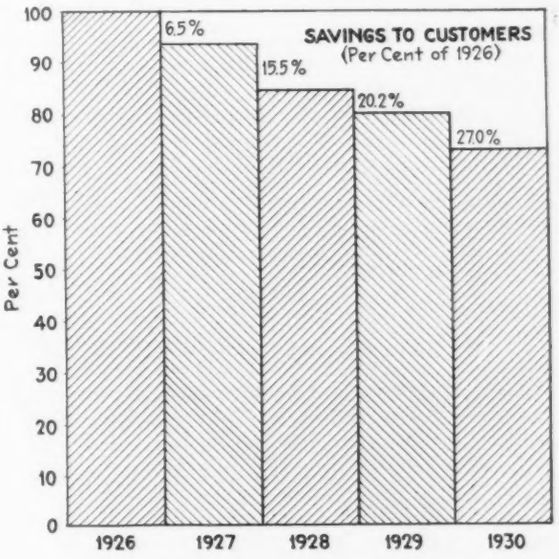
Average rate per domestic kilowatt-hour

National and average for five large Oregon companies.



Average annual kilowatt-hour use per domestic customer

1926 to 1930 inclusive. Combined average for five large Oregon companies.



Decrease in average rate per domestic kilowatt-hour

1926-1930 inclusive. Combined average of five large companies of Oregon taking the average rate for 1926 as 100 per cent. The average rates for the succeeding years are expressed in terms of per cent of 1926.

Markets for Gases Electrolyzed with Off-Peak Power

By PAUL McMICHAEL
Chemical Engineer, New York

Outlets for oxygen well established. New hydrogen markets make electrolysis of water economically feasible. Cell plant in conjunction with generating station to utilize off-peak power.

THE application of scientific research to industry during recent years has developed many new uses for hydrogen and oxygen and progress has been so rapid that in the United States the annual consumption of hydrogen exceeds 300,000,000 cu.ft. and of oxygen 3,000,000,000 cu.ft.

Most of the oxygen used in industry today is obtained by the liquefaction of air, the rare gases, argon, neon and krypton being by-products. The cost of making 99 per cent pure oxygen by air liquefaction in a favorably situated plant of high efficiency is approximately $12 a ton, or about 52 cents per 1,000 cu.ft. To secure such a cost the plant must have a large capacity and must be run continuously because the air liquefaction process does not lend itself successfully to intermittent operation.

The greatest use of oxygen is in the cutting and welding of metals, acetylene being the fuel gas most commonly employed. Hydrogen can be, and has been, used as a fuel gas in cutting, and now, as a result of the research by Irving Langmuir of the General Electric Company, it too can be used in welding. It is considered highly probable that electric welding with atomic hydrogen will ultimately displace both pneumatic and hydraulic riveting in steel construction.

In cutting metals about two parts of oxygen are used to one part of hydrogen, whereas the proportion is reversed when water is dissociated in an electrolytic cell, there being two parts of hydrogen and one of oxygen. However, now that hydrogen by itself is used for welding, it is entirely practicable, in any plant doing both cutting and welding, to balance the output from electrolytic cells against the two kinds of work to be done.

Oxygen is an industrial substitute for air

Huge savings can be effected by using oxygen instead of air in different industrial processes, but, until large quantities of oxygen are made available at low cost, most discussions of this subject will continue to have only academic interest.

However, there are preferred applications for oxygen in many industrial processes where economic conditions are such as to justify the use of tremendous volumes of oxygen at a price of even $10 a ton. Thus, while pig iron or steel could not bear the burden of $10 oxygen, there are many ferro-alloys, made only in electric furnaces, some of which cost from twenty to forty times more than steel that might well be produced in ordinary furnaces with oxygen.

While it would be uneconomical to use oxygen in a generator making water gas, it is economically practicable by partial combustion with oxygen to convert petroleum directly into oil gas suitable for the carbureting and enrichment of water gas (blue gas).*

Similarly, it is practicable with cheap oxygen to convert natural gas of a very high calorific value into a greater volume of gas having a lower calorific value, which is more suitable for domestic consumption. Plants are now actually in service which convert high-calorific-value gas in this manner by partial combustion with air. Conversion efficiencies in excess of 90 per cent are being obtained in actual practice.

With cheap oxygen available in quantity the present methods of producing carbonic acid would be also revolutionized.

Carbon black as a byproduct

By burning metallurgical coke with a deficiency of oxygen substantially pure carbon monoxide can be secured. This, in turn, can be converted to carbonic acid gas and carbon black. Theoretically, from one ton of coke (2,000 lb.) and $1\frac{1}{3}$ tons of oxygen (2,667 lb.) there would be recovered 1,000 lb. of carbon black and 3,667 lb. of carbonic acid gas, about 31,508 cu.ft.

If this process were carried out at one of the large automobile tire factories all shipping expense would be eliminated, and even at 5 cents for the carbon black there would be a handsome profit in the operation, besides a large quantity of carbonic acid gas without cost.

It is important to know that for this process oxygen is essential, because if the partial combustion is made with air the subsequent conversion cannot be effected in any practicable manner because of the presence of the inert gas nitrogen.

Oxygen is also used in smelting operations, as in the

*"*Cheaper Gas with Off-Peak Power*," Gas Age-Record, January 3, 1931.*

production of molybdenum, tungsten, cobalt, nickel and pure iron for transformers, in lead burning and aluminum welding, for medical and therapeutic purposes, in mine and fire rescue work, in aviation and as an ingredient of explosives used in mining and quarrying.

Many possible technological uses for cheap oxygen might be enumerated, but these need not be discussed here because at the present time the demand is such that a market is assured for all that might be produced at a price greater than its pro rata cost of production in electrolytic cells with off-peak available at its net increment cost of generation.

The present largest use of hydrogen is as a fuel gas in one or another of the manufactured gases, coal gas, water gas or oil gas, where it is just one constituent among many in a complex mixture. Simply as a fuel, hydrogen would have a value of not more than 25 to 30 cents a thousand cubic feet.

A large use for pure hydrogen is in the fixation of nitrogen; i.e., in the manufacture of synthetic ammonia. The world is now largely independent of natural sources of fixed nitrogen, and in the near future will be wholly independent.

Although the number of synthetic ammonia plants in the United States is being increased constantly, as yet their aggregate capacity is insufficient to supply the country's requirements for fixed nitrogen, so that Chile saltpeter is still imported in considerable quantity.

Hydrogen is used to harden various oils, the chemical reaction being the conversion of unsaturated glycerides into saturated compounds through the absorption of hydrogen. Thus, for example, fish oils are made fit for soap manufacture and cottonseed oil is converted into a lard substitute.

Hydrogen is used extensively in the brazing, welding, cutting and annealing of metals, in nickel plating on steel and in numerous chemical and metallurgical processes to provide a non-oxidizing atmosphere during high temperature operations. More and more, in industrial work, advantage is being taken of the fact that copper melted in an atmosphere of hydrogen will flow into almost inconceivably narrow cracks and crevices in steel. For example, in the manufacture of electric refrigerators it is essential that every part containing the refrigerant (e.g., sulphur dioxide) shall be gas-tight. This result is obtained at nominal cost after the containers have been fabricated by powdering them with copper dust and then heating them under a bell-jar in an atmosphere of hydrogen until the copper melts and runs into and so seals every crack hermetically.

Pure hydrogen is an essential material for many chemical syntheses, and if it could be procured in quantity at a price of 40 cents a thousand cubic feet or less its present use in this field would be multiplied many times.

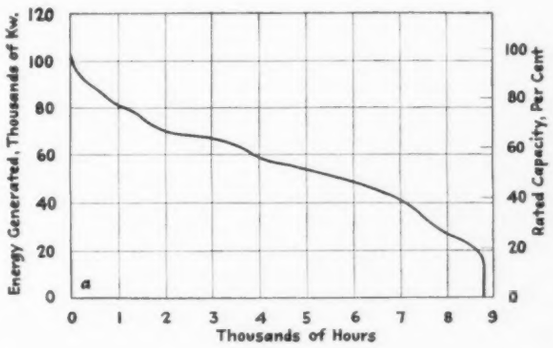
While the capital charges for a given oxygen capacity are higher with electrolytic cells than with the air liquefaction process, the decision as to the type of plant to be built must not rest on the oxygen production alone, for the hydrogen must be taken into consideration also. Now that hydrogen is used in welding, as the reducing atmos-

Table I—Economical Voltage for Cell Operation Under Various Conditions

15,000 Amp. Electrolytic Cell

Energy Available, Hours per Day	Cost of Energy per Kw.-Hr. A.C. 2.0 Mills, Voltage	2.5 Mills, Voltage	3.0 Mills Voltage
12	2.10	2.05	2.00
15	2.05	2.00	1.95
18	2.00	1.95	1.90
21	1.95	1.90	1.85

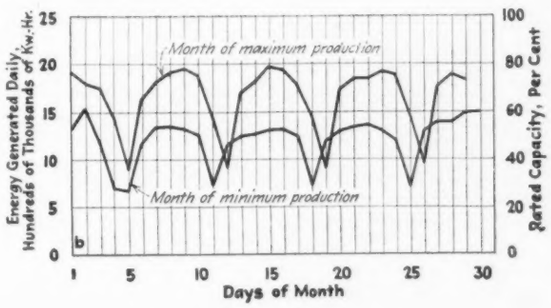
Characteristics of plant analyzed



(Top) Duration load curve.—The station operated one hour at a rate less than 15,000 kw.; fifteen hours between 15,000 and 20,000 kw.; only 78 hours at more than 95 per cent and only thirteen hours over 100 per cent.

(Left) February and September curves.

(Right) Maximum and minimum days.—Even on the maximum day there were more than nine hours during which the station operated at less than 30 per cent.


Energy Generated Daily, Hundreds of Thousands of Kw.-Hr.
Rated Capacity, Per Cent
Month of maximum production
Month of minimum production
Days of Month
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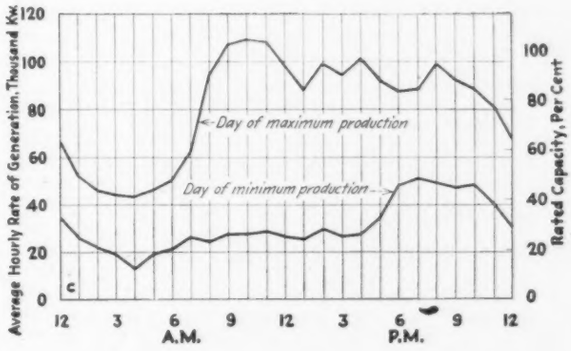

phere in brazing and annealing furnaces, and especially in so many chemical syntheses, as well as the fuel gas in cutting metals, a balanced condition between requirements and the hydrogen and oxygen production from electrolytic cells may be obtained so that

> **serious consideration may now be given to the use of electrolytic cells in the place of liquefaction equipment for the production of oxygen only. Because of the great flexibility of operation possible with electrolytic cells and the fact that air liquefaction apparatus must be operated continuously if oxygen is to be made at a reasonable cost, the advantages of electrolytic cells with power only intermittently available are apparent.**

Numerous facts must be considered and weighed before any conclusion can be reached as to the probability of an ultimate substantial profit in the generation and sale of off-peak energy by any particular central station, the most fundamental being (1) the net increment cost of generation, (2) the aggregate annual amount available at some minimum rate of generation and (3) the daily, monthly and seasonal distribution of this aggregate.

The electrolytic cells to be employed should be designed to operate at some particular direct-current voltage between 1.8 and 2.5, even though in actual operation the voltage may vary widely, either from differences in current input or from differences in cell temperature. Naturally, the cost of an electrolytic cell varies with the current and voltage for which it is designed, the cost per kilowatt capacity being progressively greater as the operating voltage rating decreases. In a plant of large capacity, for example, the estimated installed cost of a single 15,000-amp. cell designed to operate at 2.4 volts is but $10 per kilowatt rated capacity, or $360, whereas the estimated installed cost of another 15,000-amp. cell designed to operate at 1.8 volts is $30 per kilowatt rated capacity, or $810.

All factors must be weighed carefully in each instance before determination can be made of the most economical type of electrolytic cell for any particular installation. However, as an indication only, there are shown in Table I some estimates of the most economic type of 15,000-amp. electrolytic cells that might be employed in a large plant under different conditions.

In Table II are given the estimated capital requirements for an electrolytic cell plant of 10,000 kw. alternating-current capacity and the cost per thousand cubic feet of the annual production of total gases therein when consuming an aggregate of 81,680,000 kw.-hr. a.c. of surplus off-peak energy at a cost of 1.66 mills per kilowatt-hour, a price at which it is procurable. In this estimate of cost provision has been made for sufficient gas storage capacity to hold all the gases made if the electrolytic cells are operated for the aggregate period during which surplus energy would be available to their use and if consumption is evenly distributed throughout the whole 24 hours of each day.

The gas cost of 32.51 cents per thousand cubic feet shown in Table II would be decreased fractionally in cell plants of greater capacity because of the proportionately smaller gas-storage capacities required to insure continuous operation of gas-consuming industries of equivalent capacities with surplus energy only intermittently available. However, the cost of the total gases produced in cell plants of greater capacities would not be decreased materially because, as shown by the data in Table III, the large cell plants would be operated at full capacity a less fraction of the time.

Electrolytic plants attached to generation

By building the electrolytic cell plant adjacent to the central station transmission costs and losses are reduced to a minimum and the distribution system is kept clear for the transmission of firm energy, and by locating industrial plants that will consume the gases in the same vicinity, the hydrogen and oxygen produced do not have to be compressed for transportation, but can be stored and pumped under relatively low pressures.

Electrolytic cells, under control of the central station dispatcher, will consume off-peak energy, if, when and as it is available, and may instantly be cut off when the energy is required elsewhere to satisfy a firm demand. The hydrogen and oxygen made intermittently in the electrolytic cells, when surplus energy is available, may be taken by the consuming industries throughout the entire day, gas storage holders compensating for the difference in rates of production and consumption.

An electrolytic cell is a tool of high efficiency at its rated capacity and it will operate at not less than 75 to 80 per cent of this high efficiency with loads varying from 25 to 250 per cent of its rating. It begins to function almost instantly when starting up and can be shut off completely at any time without injury. Finally,

Table II—Electrolytic Cell Plant, Capacity Equivalent to 10,000 Kw. A.C.

Capital Requirements	
Cells	
15,000-amp. x 2.0 volts (30 kw. capacity)	
300 cells (9,000 kw. a.c.) at $20 per kw. installed	$180,000
Land, building and equipment—40 per cent of cell cost	72,000
Converting Equipment	
11,000-volt a.c./660-volt d.c. motor-generator sets	
9,000 kw. d.c. capacity at $15 per kw. installed	135,000
Land, building and equipment—20 per cent of conversion equipment cost	27,000
Gas Storage and Handling Equipment	
One 2,000,000-cu ft. hydrogen holder, etc	235,000
One 1,000,000-cu ft. oxygen holder, etc	135,000
Gas mains	10,000
Total plant cost	$794,000

Operation and Maintenance	
Energy, 81,680,000 kw.-hr. a.c. at 1.66 mills	$135,589
Cells	11,000
Converting equipment	7,000
Gas storage and handling equipment	5,606
Operation cost	$159,195
Fixed charges, 15 per cent of capital requirement	119,100
Total production cost	$278,295
Cost of hydrogen, two-thirds of total production cost	$185,530
Cost of oxygen, one-third of total production cost	92,765
Hydrogen made, thousands of cubic feet	578,839
Oxygen made, thousands of cubic feet	289,419
1,000 cu.ft. total gases made—73,512,000 kw. d.c. x 11.8111	868,258
Cost of gases per 1,000 cu.ft.	32.51

Table III—Availability of Off-Peak Energy in Plant Analyzed

Cell Capacity, Kw. A.C.	Proportion of Time in Per Cent Cells Operate: Full Capacity	Part Capacity	Cells Off	Aggregate Annual Consumption of Cells, Kw.-Hr. A.C.
10,000	88.0	9.6	2.4	81,680,000
20,000	81.4	16.2	2.4	158,380,000
30,000	61.7	35.9	2.4	221,170,000

and of greatest importance to the central-station engineer, the operation of electrolytic cell plants on the system with off-peak energy not only makes it possible to operate the station continuously at a predetermined rate, but also increases the load factor and improves relaying conditions for system operation.

Electrolytic cells will absorb any normal load fluctuation and, furthermore, the central-station dispatcher can regulate the current input so that any reasonable predetermined load may be imposed on the central-station generating equipment, and he can change this station load from time to time in approximate multiples of the capacities of the generating units.

By increasing the station load factor, especially during the hours of low system demand, and eliminating short-period load fluctuations over-all efficiencies of generation may be increased in varying degrees, depending upon the normal efficiencies of the generating units involved.

With the continuing improvement in thermal conversion efficiency from fuel to electric energy that is being effected in generating equipment, and with the increasingly larger investment in plant necessary to obtain this result, fixed charges become the major fraction of the cost of generating electric energy in central stations. Unless fixed charges are diminished by wider spread over greater amounts of energy generated to supply firm demand, or operating conditions are so modified that improved thermal conversion can be attained by substantially continuous operation at rates of highest efficiency, the benefits resulting from the installation of better designed generating equipment and accessories are overtaken by the fixed charges on the increased cost of plant.

Fixed charges are assessed against energy generated to supply firm demand. By continuing this practice, and also utilizing available equipment to generate energy when it is *not* needed to satisfy firm demand, then considerable quantities of surplus energy, *free from fixed charges*, are made available for use or sale.

There are central stations in the Mississippi Basin that would derive substantial direct profit from the sale of surplus off-peak electric energy at a price of 1.5 mills per kilowatt-hour. Analysis of the operating records of one such plant disclosed that superposition on its annual duration load curve of the loads of electrolytic cell plants of 10,000, 20,000 and 30,000 kw. a.c. capacities increased the annual capacity-use factor from 56.7 per cent to 65.6, 73.9 and 80.7 per cent, respectively, and that off-peak energy was available in the quantities and durations shown in Table III.

This paper supplements "What Price Surplus Energy"* and embodies answers to a questionary compiled from readers' comments upon practicability of generating off-peak electric energy and selling it profitably.

The net increment cost of generating surplus energy during off-peak periods in an efficiently operated base-load, pulverized-coal-fired, steam-generating station with an installed capacity in excess of 100,000 kw. was determined, and found to be appreciably less than the cost of fuel required for its generation under the conditions (1.66 mills for 81,680,000 kw.-hr. of off-peak energy).

This station is one of several in its system, has the lowest coal cost, the most efficient generating units and, naturally, is operated to supply the base load. Furthermore, the system of which it is a unit has interconnections with two other systems, one of which has considerable hydro-electric generating capacity.

That conditions at this station were not abnormal and that it was efficiently operated may be deduced from the following:

1. The annual capacity use factor was 56.7 per cent.
2. The average over-all fuel requirement for conversion from coal to electric energy was 14,431 B.t.u. per kilowatt-hour alternating current generated.
3. The quality of the coal consumed was mediocre

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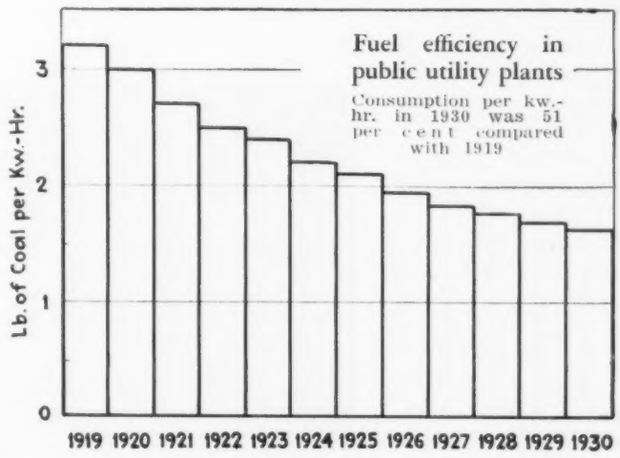
Fuel Consumption 51 per Cent of 1919 Rate

Coal consumption in public utility plants was only 7 per cent greater in 1930 than in 1925, although the output from fuel increased 45 per cent, according to a report by the United States Geological Survey. The use of natural gas multiplied nearly sixfold since 1919, but less fuel oil is being used than in the first half of the decade.

Including the coal-equivalent of oil and gas, consumption rose from 38,880,000 tons in 1919 to 50,654,000 tons in 1930, with a maximum in 1929 of 52,574,000 tons,


Fuel efficiency in public utility plants
Consumption per kw.-hr. in 1930 was 51 per cent compared with 1919
Lb. of Coal per Kw.-Hr.
0
1
2
3
1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930

while the corresponding kilowatt-hours (excluding energy generated from wood) were 24,175,000,000, 62,448,000,000 and 62,514,000,000, respectively. These values indicate a decrease from 3.2 lb. of coal per kw.-hr. in 1919 to 1.62 lb. in 1930.

The designation "public utility plants" as here used embraces not only central stations but also electric railway plants and others contributing energy for public use or sale.

*"Electrical World," May 10, 1930.

Street Lighting and Traffic Accidents

By KIRK M. REID
Illuminating Engineer General Electric Company, Nela Park Engineering Department, Cleveland, Ohio

THREE surveys* may be cited in support of the statement that it is possible to correlate the traffic accidents with the adequacy or inadequacy of street lighting. There are many variables involved in the frequency of traffic accidents—traffic density, pedestrian density, season weather, law enforcement, etc. An index which appears to give results largely independent of these variable factors other than lighting is that of the comparison of two ratios. One of these is the ratio of night to day accidents on well-lighted streets; the other the same ratio for poorly lighted streets. The disparity between these two may be regarded as representing the actual reduction which has been experienced in night hazard, under local conditions, through adequate street lighting. An analysis of the three surveys indicates that adequate lighting does and will decrease the night accidents.

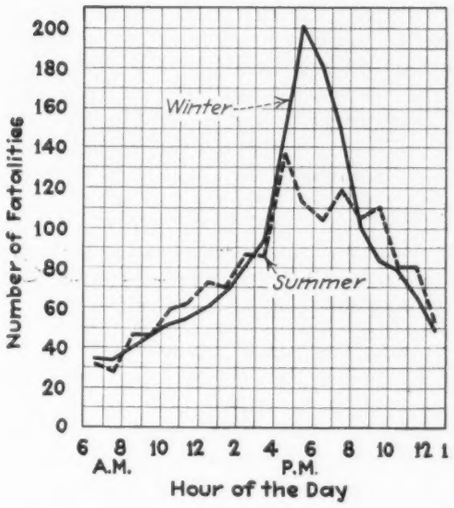
One of our earliest investigations on the relation between street lighting and traffic accidents was conducted in the city of Cleveland during the year 1923. This investigation consisted of a comparison of the night traffic experience on four main thoroughfares — Euclid Avenue, Woodland Avenue, Superior Avenue and St. Clair Avenue. All of these were heavily traveled main thoroughfares and had double-track street car lines. At that time two of these, Euclid Avenue and Woodland Avenue, were well lighted. The other two, Superior Avenue and St. Clair Avenue, were poorly lighted.

An analysis of the Police Department records showed that during the daytime, when of course there was no difference in the illumination on these streets, Euclid and Woodland Avenues had more traffic fatalities than the other two and therefore might properly be regarded as more dangerous from the traffic standpoint. At night, however, the situation was reversed. During the year there was only one night fatality on Euclid and one on Woodland, the two well-lighted streets, whereas on poorly lighted St. Clair there were seven night fatalities and on poorly lighted Superior there were eight. Apparently the presence of the good lighting had a marked effect in reducing the night traffic fatalities. Or, conversely, the absence of good lighting made the two poorly lighted thoroughfares extremely hazardous.

A new lighting system on Superior Avenue was placed in operation October 9, 1925. From January 1 to

**Based on paper read before American Society of Municipal Engineers.*

A Cleveland avenue before and after adequate lighting



Traffic accidents in winter dusk exceeded midsummer frequency

Based on fatality data from California, New York, Pennsylvania and North Carolina.

October 9, 1925, there were five night fatalities on Superior Avenue. This is at the rate of something over six night fatalities a year, indicating that the night traffic hazard was substantially the same as was found in the investigation two years earlier, when there were eight night fatalities.

During the twelve-month period following the installation of the good lighting system there was only one night fatality on the street, and during the second twelve months there were only three—an average of two a year.

St. Clair Avenue was not relighted until October 1, 1927. During the twelve-month period before the installation of the good lighting system there were six night fatalities on the street, and there were also six night fatalities during the second preceding twelve-month period. This experience is a good check on the seven night fatalities which were found on St. Clair Avenue in the 1923 investigation. The year following the installation of the good lighting system there were three night fatalities on St. Clair Avenue—two of these intoxicated pedestrians—and during the second twelve months there was only one—a pedestrian struck by a hit-skip driver. Here, as on Superior Avenue, there was an average of only two night fatalities a year under good lighting, as compared with an average of six or more under poor lighting. The new lighting system on St. Clair Avenue consists of lantern-type units, spaced 100 ft. apart, with 10,000-lumen lamps and dome refractors. It might be mentioned that while these lamps are considerably smaller than those employed on Superior Avenue, St. Clair Avenue is a much narrower street.

One might safely conclude from the traffic fatality experience on these two thoroughfares that the good lighting systems had accomplished all that could reasonably be expected of them.

Cleveland as a whole

The foregoing investigation covered relatively short stretches of heavily traveled thoroughfares, and the approximately three-to-one reduction in night traffic fatalities experienced cannot be expected throughout an entire city. Our next logical step, therefore, is a broader investigation, covering all the traffic fatalities in the city.

A basis of a yardstick for measuring the efficacy of highway lighting is very simple. It is merely a comparison between two ratios—the ratio of the night accidents to the day accidents on the well-lighted streets, compared with the ratio of the night accidents to the day accidents on the poorly lighted streets. The day accidents thus give us an "index" which serves to compensate for the variable factors, other than lighting, which affect the number of traffic accidents.

The complete tabulation of the Cleveland analysis, following this method, is presented in Table I. It will be noted that on the well-lighted residence streets there were no night fatalities, as compared with six night fatalities on the poorly lighted residence streets; it is my opinion, however, that the total number of fatalities on the residence streets is not sufficient to place much weight

Six to eight fatalities a year dropped to two a year after the improved lighting — one of these was a hit-skip case and the other involved an intoxicated pedestrian.

Table I—Relation of Lighting to Fatal Traffic Accidents

Month	Residential Street Lighting: Inadequate* Day	Inadequate* Night	Adequate* Day	Adequate* Night	Thoroughfare Street Lighting: Inadequate Day	Inadequate Night	Adequate Day	Adequate Night	Total
Sept., 1929	2	1	1	0	6	8	7	6	31
Oct., 1929	1	1	1	0	3	12	5	8	31
Nov., 1929	1	2	0	0	2	7	3	14	29
Dec., 1929	0	0	0	0	1	4	4	6	13
Jan., 1930	0	0	0	0	2	4	3	7	16
Feb., 1930	0	0	0	0	0	1	4	6	11
March, 1930	2	0	0	0	6	8	6	4	26
April, 1930	4	0	1	0	3	5	5	6	24
May, 1930	1	0	1	0	3	5	7	5	22
June, 1930	5	2	2	0	3	4	5	1	22
July, 1930	4	0	0	0	3	3	5	3	18
Aug., 1930	2	0	1	0	4	4	6	3	20
	22	6	7	0	36	65	58	69	263

*Division between adequate and inadequate street lighting based upon the Illuminating Engineering Society Code of Street Lighting.

Analysis of the Data

Residence Streets

Ratio, night to day fatalities, inadequate lighting, is 6/22 = 0.27
Ratio, night to day fatalities, adequate lighting, is 0/ 7 = 0.00

Thoroughfares

Ratio, night to day fatalities, inadequate lighting, is 65/86 = 1.81
Ratio, night to day fatalities, adequate lighting, is 69/58 = 1.19

Computed Night Fatalities if Entire City were Inadequately Lighted

On residence streets now inadequately lighted		6
On residence streets now adequately lighted	7×0.27 =	2
On thoroughfares now inadequately lighted		65
On thoroughfares now adequately lighted	58×1.81 =	105
Total		178

Computed Night Fatalities if Entire City were Adequately Lighted

On residence streets now inadequately lighted	22×0 =	0
On residence streets now adequately lighted		0
On thoroughfares now inadequately lighted	36×1.19 =	43
On thoroughfares now adequately lighted		69
Total		112

Computed Difference between Adequate and Inadequate Street Lighting

178 − 112 = 66 night fatalities a year avoided or 66 ÷ 178 = 37 per cent of the night fatalities avoided.

upon this result. On the poorly lighted thoroughfare there were 81 per cent more fatalities by night than by day, whereas on the well-lighted thoroughfares there were only 19 per cent more fatalities by night than by day. The net result is that under Cleveland conditions about 35 per cent—something over one out of three—of the night traffic fatalities may be avoided by proper street lighting.

In this investigation the basis of the street classification as to adequate or inadequate lighting is the new Code of Street Lighting, prepared by the street lighting committee of the Illuminating Engineering Society.

Indiana highway fatalities

The third investigation covers all the traffic fatalities on the state roads of Indiana for the twelve months ended August 31, 1930. This detailed analysis is presented in Table II, and it permits drawing many interesting conclusions as to when and how rural traffic fatalities occur. To summarize those data which have a direct bearing upon illumination, 37 per cent of the fatal accidents occurred during the day, 9 per cent during dusk, and 54 per cent after dark. This analysis, by the way, is not to be regarded as complete in that it does not cover county or township roads, but it does cover all the Indiana state roads for a full year.

Based upon a traffic survey, A. H. Hinkle, superintendent of maintenance Indiana State Highway Commission, estimates that about two-thirds of the total 24-hour traffic is on the state roads of Indiana during the daytime. This means that, after daylight has failed or is failing, about one-third of the traffic produces almost two-thirds of the fatalities. By day two-thirds of the traffic produces only one-third of the fatalities. The relative night hazard, therefore, is about four times the day hazard.

A compilation of fatality data from four typical states has been made by S. J. Williams, director of the National Safety Council. He concludes that about 35 per cent of the night traffic accidents are directly or indirectly attributable to lack of illumination. There would seem to be ample justification for comprehensive trials of highway lighting, to determine to what extent it will reduce this appalling night hazard.

Table II—Fatalities on State Roads in Relation to Lighting

Month	Collision, Two Motor Vehicles: Light	Dusk	Dark	Motor Vehicle Hit by Train or Interurban: Light	Dusk	Dark	Motor Vehicle Drove off Road: Light	Dusk	Dark	Pedestrian Hit: Light	Dusk	Dark	Miscellaneous: Light	Dusk	Dark	Total: Light	Dusk	Dark
September, 1929	1	..	5	2	..	1	2	..	3	1	..	1	1	..	2	7	0	12
October, 1929	5	1	10	1	..	4	4	1	4	2	2	2	..	3	1	12	7	21
November, 1929	2	..	5	..	..	..	1	..	2	..	2	3	1	1	1	4	3	11
December, 1929	2	..	4	..	..	5	..	..	1	..	..	5	..	..	..	2	0	15
January, 1930	3	..	3	1	..	2	..	..	3	1	..	4	1	..	1	6	0	13
February, 1930	..	..	3	..	..	1	2	1	3	2	..	2	1	..	1	5	1	10
March, 1930	3	..	..	1	..	2	1	..	2	..	..	4	..	1	..	5	1	8
April, 1930	5	..	4	3	..	..	3	..	2	1	1	1	1	..	1	13	1	8
May, 1930	2	..	6	3	..	..	..	3	2	1	..	2	..	..	1	6	3	11
June, 1930	2	1	1	1	..	1	2	..	..	1	1	..	2	..	1	8	2	3
July, 1930	3	1	6	..	..	..	3	..	..	1	1	1	4	..	3	11	2	10
August, 1930	1	..	11	2	..	..	4	1	4	2	..	..	1	1	..	10	2	15
	29	3	58	14	0	16	22	6	26	12	7	25	12	6	12	89	22	137
		90			30			54			44			30			248	
Per cent of total		36			12			22			18			12		36	9	55

*This analysis was made by A. H. Hinkle, superintendent of maintenance Indiana State Highway Commission, and Kirk M. Reid, Nela Park, Engineering Department, Cleveland, Ohio, of traffic and lighting on the state roads of Indiana, September, 1929, through August, 1930.

Correcting Power Factor While Grinding Wood Pulp

By W. PAUL LYMAN
General Electric Company, New Orleans, La.

By applying synchronous machines to the motorization of dual-drive pulper equipment the Bogalusa Paper Company of Bogalusa, La., was able to take advantage of power-factor clauses in purchased energy contracts and secure satisfactory operating performance.

This paper company recently decided to add another kraft mill and another board mill unit to an already large plant equipped with four board machines and one kraft machine. The company was, at the time, negotiating with the Louisiana Power & Light Company for the purchase of a portion of its power requirements. Its own plant, of 8,000 kw. capacity, was approximately loaded and the loss of its large generating unit would necessitate a shut-down of at least a part of the plant.

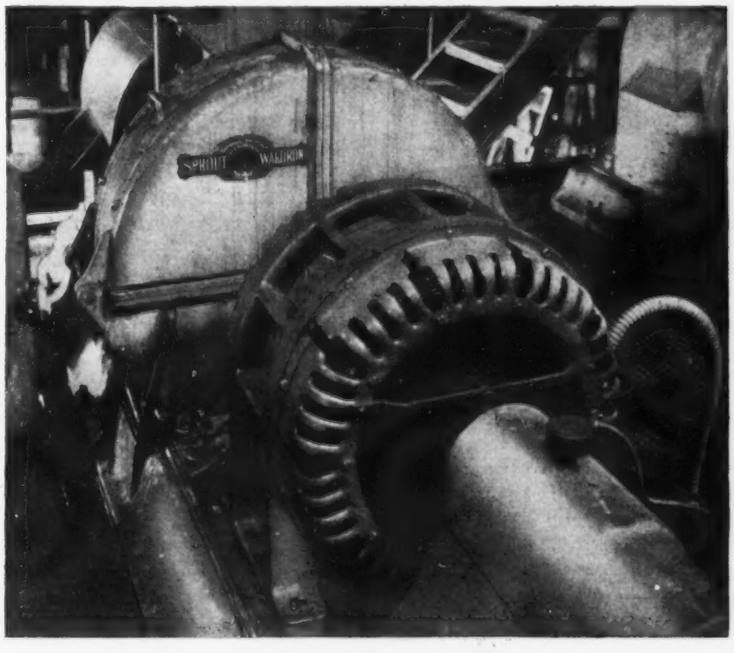
Because of the location of Bogalusa with respect to the generating plants of the Louisiana Power & Light Company it was most important to the power company that the power factor of the load picked up at this remote point be as near unity as possible. As the greater part of the paper mill load came through induction motors, the over-all power factor at which its plant was operating was less than 70 per cent. An analysis of the rate offered by the power company indicated that it would not be economical to purchase power even in a 5,000-kw. block unless the power factor was improved; in fact, a penalty would be inflicted if the power factor of the load fell below 80 per cent.

Main motors to be considered in these two proposed units consisted of four Jordan motors, 400 hp. each; four Jordan motors, 250 hp. each; one compressor motor, 250 hp.; one shredder motor, 150 hp., and eight pulper motors, 100 hp. each. It was finally decided that if synchronous motors with 0.8 leading power factor characteristics were used for all these applications the desired power factor would be obtained on the portion of the load the power company would serve. The contract was closed on this basis and the results were as anticipated.

The problem of "take-up" on the adjustable end of the dual-drive pulper machines to which these motors were applied required special attention. The displacement of the rotor with respect to the stator of 3 or 4 in. in the conventionally used squirrel-cage motor ordinarily has no effect upon the motor's operation, especially as these thrusts only occur once in a great while, and then the rotor is returned in a few seconds to its normal operating position. However, in applying synchronous motors here it was realized that standard collector rings could not be used, as any foreign matter getting into the stock and being fed between the disks of the machine would cause the adjustable section to bound back against the spring at the take-up end, thus displacing standard rings from under the brushes. Also, it would be necessary for the operator to make frequent adjustments by hand to regulate the grade of his stock to the slush bins, and these adjustments might cause the rings to leave the brushes. The engineers found that there was enough room between the spider and the motor bearing of a standard synchronous motor to use collector rings $4\frac{1}{2}$ in. wide. The design was thus made on this basis.

With the above motors four semi-automatic starters were supplied, each to control the two motors on one machine. In other words, both motors on a machine were started from one oil switch, although a motor field rheostat was provided for each motor on its panel. These starters were assembled by the user along with similar starters for other motors as a unit switchboard. An exciter bus was constructed over the entire length of the board and energized from a motor-generator set, thus furnishing excitation to all the motors.

The pulpers have now been in operation for some time and the user reports them satisfactory in every respect. Incidentally the paper company, realizing the damp conditions under which these machines operate, constructed neat metal covers over the motors. These covers are provided with air ducts at the bottom and ventilating stacks on the top to insure a sufficient amount of cooling air.



Synchronous motor applied to pulper dual drive

READERS' FORUM

Easy Register Ratio Determination (?)

To the Editor of the ELECTRICAL WORLD:

The May 2 issue of the ELECTRICAL WORLD contained a letter in the Readers' Forum on "Easy Register Ratio Determination" and offered a substitute formula for the one appearing in the March 21 issue under "Rapid Determination of Watt-Hour Meter Register Ratio" by the writers of this letter.

The formula as suggested contains all the quantities that appear in our expression, and to use it in the field it is necessary to have available supplementary information such as the correct knowledge of the reduction ratio and the basic test constant of the meter. It is also essential that the tester be informed as to whether or not the constant of the meter being tested is based on the 5-amp., 110-volt constants.

The necessity of having this information is clearly demonstrated in both examples quoted in the article of May 2, both examples being incorrect. Thus:

Meter, Westinghouse type C, sub B, three phase, $2\frac{1}{2}$ element, 40 amp. and 440 volts. Register constant 1, kw.-hr. first dial 100. As this meter has four current coils it is equivalent to two two-element meters or four single-element meters. The reduction ratio is 5, not $6\frac{1}{2}$, and the value of the register ratio, according to the May 2 formula, should be as follows:

$$R_r = \frac{100{,}000}{5 \times (4 \times 8 \times 2) \times \frac{2}{3}} = 468.75$$

This value is identical with the value obtained by using the formula for R_r given in the March 21 issue, as follows:

$$R_r = \frac{1 \times 100 \times 150}{4 \times 8} = 468.75$$

This checks with the Meterman's Handbook value as given on page 815 of the 1923 edition, also checks with the handbook of Westinghouse watt-hour meters IB-5150-C, page 103.

In the second example, G.E. meter type D-6, three phase, $2\frac{1}{2}$ element, 100 amp. and 2,200 volts, using transformers, register constant 100, kw.-hr. first dial 10. This meter is not based on the 5-amp., 110-volt constants; a statement to this effect is contained in the article of March 21. The reason for this is that in the three-phase, four-wire installation the voltage rating is given to neutral instead of between lines. The constant for a 5-amp., 110-volt meter of this type is 1 instead of 0.9. Using this value in the formula the expression would be as follows:

$$R_r = \frac{10{,}000 \times 100}{100 \times 20 \times 20 \times 1} = 25$$

This value also checks the value given in the March 21 issue, which was given as follows:

$$R_r = \frac{100 \times 10 \times 10}{20 \times 20} = 25.$$

This value agrees with the value given in the General Electric Company bulletin GEB-20, page 27.

As seen from the foregoing discussion, both the expressions for the determination of ratios are satisfactory; each, however, must be supplemented by additional information concerning the meter. For this reason all the additional information concerning the meters was assembled in tabular form in the March 21 article. In order that the formula given in the letter of May 2, 1931, may be used in the field either the manufacturer's information bulletin, the Meterman's Handbook or a similar table must be available or the work is subject to informational error.

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MAX A. FAUCETT.

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Two Essential Considerations Confront Utilities

To the Editor of the ELECTRICAL WORLD:

The article on electric water heaters by Messrs. Randolph and McCormick and your own editorial comments in the May 16 issue of ELECTRICAL WORLD are of more than passing interest, in view of the enormous potential possibilities that obtain through this class of business, and will no doubt receive due attention.

It certainly does seem as if there had been undue delay in pushing ahead with greater intensity and greater gusto the best load-building appliance available at the present time for the domestic market. As you state, this delay may have been caused by there having been too many systems suggested and considered by those interested to arrive at any one definite solution, owing to a desire on every one's part to obtain a product which could be 100 per cent perfect from every angle. In this connection it is well to note that there is bound to be a conflict in viewpoint between the operating men, who see the usefulness of the appliance entirely as a means of improving the load curve performance, and the commercial men, who see it entirely as a means of keeping up or increasing the amount of sales made each month, both of which are, indeed, necessary adjuncts of a good-looking consolidated balance sheet for any company.

When coming down to fundamentals, however, the fact remains that there are two essential considerations which the electric utilities are faced with today, namely, a slow but gradual increase in investment cost per dollar of return and a demand in many quarters for lower rates, both of which are compelling forces toward a need for increasing the kilowatt-hours sold without, or at least with as little as possible, additional capital expenditure, and which expressed in simple terms means the necessity for improving the load factor. If this is sufficiently basic and fundamental in its aspect to affect decisions, it would tend to favor the type of water heater that comes closest to fulfilling these requirements, even if a certain amount of resistance should be encountered on the part of the purchaser to begin with, but which can be gradually overcome and ultimately solved to the greatest benefit of both company and customer.

No doubt the definite course to be followed in the development of this business is in the hands of the executive, as he is the supreme arbiter between the forces at play within his own organization and the one who knows best just what results he wishes to obtain, having continuously in mind the general perspective of the situation as a whole, which enables him to gage better than any one else the needs and requirements of the hour.

EUGENE VINET,
Engineer.

Evanston, Ill.

Men of the Industry

S. Stokes Becomes Consulting Engineer in St. Louis

STANLEY STOKES, who has been actively connected with the operations of the Union Electric Light & Power Company and its subsidiaries for a number of years, has recently been named consulting electrical engineer. This change will permit Mr. Stokes to devote his

entire attention to major engineering matters.

A graduate of Missouri University in electrical engineering, Mr. Stokes first became identified with the Telluride Power Company and later with the Mississippi River Power Distributing Company, where he engaged in cost analysis work, rate research and later power sales. Subsequenty he was transferred to the Union Electric Light & Power Company as superintendent of the outlying plants division, remaining in this capacity until 1927, when in addition to acting as power supervisor he took over the duties of chief electrical engineer relinquished by H. W. Eales, who joined the Byllesby Engineering & Management Corporation. His most recent work has been in connection with the design of a new type of swinging wood-crossarm steel-tower transmission line 125 miles in length, carrying power to St. Louis from the Osage hydro-electric development. Mr. Stokes is a fellow of the American Institute of Electrical Engineers.

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KARL T. COMPTON, president of the Massachusetts Institute of Technology, has been awarded the Rumford medal by the American Academy of Arts and Sciences. The award was made in recognition of Dr. Compton's contributions in the field of thermionics, the study of electron emission from hot filaments and cathodes, and in spectroscopics, the study of matter by means of light waves.

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DR. C. M. SLACK, research engineer of the Westinghouse Lamp Company, recently received the award for outstanding accomplishments and the accompanying $500 in cash for the development of a glass bubble to be used as a window in the Lenard ray tube. This award is given each year by the Westinghouse organization for the most important changes either in manufacturing methods or the design of a product made by the company.

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W. W. Austin Heads Middle West Division

WALTER W. AUSTIN, a prominent figure in the electric light and power industry in the Middle West, has been elected president of the Middle West Division of the National Electric Light Association. Mr. Austin is a resident of Cottonwood Falls, Kan., and is president of the Inter-County Electric Company, an independent organization operating in a group of towns in central Kansas and which was founded by Mr. Austin in 1907 as the Home Light & Power Company. In addition to furnishing electric service the company

also operates an ice utility with service to nine towns. Mr. Austin has served three terms as president of the Kansas section, N.E.L.A.

Harry Reid New N.E.L.A. Vice-President

HARRY REID, who has been prominently and actively identified with the electric light and power industry for more than 25 years, has been elected a vice-president of the National Electric Light Association. At the present time he is president of the National Electric Power

Company and the National Public Service Corporation, two of the largest units in the Middle West Utilities System, and also chairman of the Public Relations National Section of the National Electric Light Association. In 1906 Mr. Reid embarked on a pioneer venture by purchasing, with other associates, the Versailles (Ky.) Electric Light Company. Later he became sole owner of this company, and with it as a nucleus gradually put together a group of companies which in 1912 became part of the Middle West Utilities System and were organized with other companies into the Kentucky Utilities Company. From 1912 he served as president of the Kentucky Utilities Company and from 1917 to 1927 as president of the Interstate Public Service Company of Indiana.

Early in 1927 Mr. Reid returned to the East to become president of the National Electric Power Company and the National Public Service Corporation, which had just been acquired by the Middle West Utilities System. In addition to being active in the National Electric Light Association, Mr. Reid is a member of the A.I.E.E., A.E.R.A, A.S.M.E. and other similar societies.

W. R. Emerson Made Executive of Oklahoma Utility

W. R. EMERSON, who has been connected with the public utility industry in Oklahoma for 25 years, has been elected vice-president and treasurer of the Oklahoma Gas & Electric Company. Mr. Emerson has a long record of service with the Byllesby Engineering & Management Corporation, devoting his attention especially to the development of its utility accounting system. He was formerly secretary and treasurer Oklahoma Gas & Electric Company.

Mr. Emerson has taken an active part in association work, having been chairman of the Accounting National Section of the National Electric Light Association and chairman of the accounting section of the Southwestern Geographic Division.

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MORSE DELL PLAIN has been elected president of the Gary (Ind.) Heat, Light & Water Company, formerly a holding of the United States Steel Corporation, now in control of the Insull interests. George N. Rooker, who resigned as president of the old company, was elected first vice-president of the new organization. The old directors resigned and a new board, of which Samuel Insull, Jr., was named chairman, was elected.

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WILLIAM J. MCILVANE, formerly connected with McIlvane, Burr & Company, Inc., has joined the Bridgeport Brass Company, Bridgeport, Conn., as central station sales manager. Mr. McIlvane is well qualified for the new work he has undertaken. He received his engineering training at the Carnegie Institute of Technology and spent many years with the Copperweld Steel Company in the capacity of Eastern sales manager. This background was broadened by the experience he obtained when he established his own business.

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C. E. SKINNER, assistant director of engineering of the Westinghouse Electric & Manufacturing Company and president-elect of the American Institute of Electrical Engineers, received the award of the Lamme medal June 8 at the commencement exercises of the Ohio State University for meritorius achievement in engineering.

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T. D. Crocker Assumes New Executive Duties

T. D. CROCKER, recently elected a vice-president of the Northern States Power Company, has been associated with that utility since 1912, when he entered its employ as commercial engineer at St. Paul. One year later he became assistant to the general manager. In 1918 he became assistant vice-president in charge of operation and in 1923 was appointed assistant general manager, which position he held until his recent election as vice-president.

Mr. Crocker was born in Cleveland and was graduated from Ohio State University in 1904. In the same year he entered the employ of the Milwaukee Electric Railway & Light Company, starting in the power plant department.

He was associated with this organization from 1904 to 1912, occupying various offices and finally that of commercial engineer of the company.

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CLARK BAKER, SR., for 21 years with the National Lamp Works of the General Electric Company, Oakland, Cal., has severed his connection with the company. Regret was expressed at his discontinuance of the promotional and educational work of the National Lamp Works in this territory, for which Mr. Baker has become nationally famous. A pioneer in the field of lighting, he has had a hand in many movements which have resulted in the effective development of modern lighting. Recognition of the educational and promotional work he did was accorded him by the General Electric Company in 1929 when the Charles A. Coffin medal for signal contributions by employees of that company was awarded to him.

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ROGER B. MCWHORTER, who has been prominent in engineering activities in Louisiana, has been appointed chief engineer of the Federal Power Commission.

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OBITUARY

HANS C. SPECHT, consulting engineer, small motor engineering, Westinghouse Electric & Manufacturing Company, Springfield, Mass., died May 17. He was a native of Germany, a graduate of the technical college in Karlsruhe, and a member of the American Institute of Electrical Engineers.

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DR. SAMUEL WILSON PARR, professor emeritus of applied chemistry at the University of Illinois, died at Urbana, Ill., on May 16. He was widely known in power-plant circles for his experimental investigations in the calorimetry of fuels and the development of the Parr low-temperature process for coking Illinois coal. One of his more recent investigations led to the development of the Parr treatment for boiler-feed water to prevent rapid embrittlement of the boiler metal.

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WALTER ALFRED MOSER, 45, district manager of the Westinghouse Electric Manufacturing Company in Salt Lake City, died at his home in that city May 22, after an illness of seven weeks. Following graduation from the University of Nebraska, school of engineering, in 1907, he became associated with the Westinghouse company. He had been district manager of the company's Salt Lake City branch for the past four years. Mr. Moser was one of the outstanding figures in Salt Lake City and the intermountain territory in actively promoting the interests of the electrical industry. He was a past-president of the Electrical League of Utah and a member of the Utah Society of Engineers and the American Institute of Electrical Engineers.

Financial and Statistical News

THE utilities are living up to the term "shock-proof" sometimes applied to them. Despite many rate reductions 50 of the largest companies show earnings for the year just ended only 1.5 per cent under those of the previous year. Dividend changes are virtually negligible and in the great majority of cases payrolls are being well maintained.

——THE AVERAGE OF 37 POWER AND LIGHT COMMON STOCKS is up a point for the week to 58.3, against a high for the year of 74 and a low of 56.7. High-grade bond averages have strengthened further, but only marginally.

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NEW CAPITAL ISSUES

A new issue of $21,000,000 first mortgage sinking fund gold bonds 4½ per cent series, due 1979, of Safe Harbor Water Power Corporation, unconditionally guaranteed by Consolidated Gas, Electric Light & Power Company of Baltimore, was offered at 96½ to yield 4.68 per cent. The corporation was organized at the instance of Consolidated Gas of Baltimore and Pennsylvania Water & Power Company.

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During the second week of June the Northern States Power Company made an offering of refunding mortgage gold bonds, priced at 98½ and interest, yielding 4.59 per cent, a piece of financing involving a total of $10,000,000.

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Portland General Electric Company issued 4 per cent gold notes totaling $7,500,000, the price being 99¼ and interest, yielding more than 4.50 per cent.

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Pennsylvania Transmission Company Launched

THE PENNSYLVANIA TRANSMISSION COMPANY has been organized under Pennsylvania laws by officials of the Safe Harbor Water Power Corporation, Lexington Building, Baltimore, Md., affiliated with the Pennsylvania Water & Power Company, to construct and operate a steel tower transmission line from Safe Harbor, Pa., through Lancaster and York Counties to the Pennsylvania-Maryland state line. The parent organization is now building a hydro-electric generating plant on the Susquehanna River at that place, with initial capacity of 255,000 hp., to be divided into six turbine units of 42,500 hp. rating. The station will have an ultimate output of 500,000 hp. The transmission company will build two single-tower steel transmission lines.

The new transmission company has been chartered with a nominal capital of $5,000, which is to be increased at an early date to $2,000,000.

Eastern Utility Group Sold at Auction

THE GROUP OF UTILITY PROPERTIES comprising Atlantic Public Utilities, Inc., Atlantic Public Service Associates, Inc., Keystone Water Works & Electric Corporation and North American Water Works & Electric Corporation has been sold at public auction in Wilmington, Del., by Clarence A. Southerland and Ralph J. Ritchie, receivers.

This sale was part of a general plan of reorganization by which the National Electric Power system, Eastern unit of the Insull group, is to acquire the equity stock and bonds of this group of properties, serving 200 communities and with plant and property assets amounting to $28,893,587.

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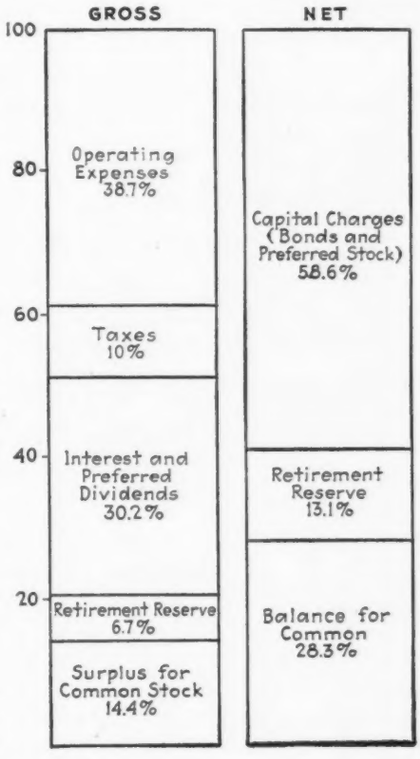
Simpler Statements Help Improve Public Relations

SENTIMENT in favor of more intelligible financial statements has gained headway in the past year or two. Many utilities have simplified their statements and monthly reports and have made them more readable.



A utility executive who has done much in this direction expressed the opinion to the ELECTRICAL WORLD that it might help public relations and tend to check political attack if all utilities would present their earnings statements in readily intelligible form. Such impressions as that enormous profits are made every year, that stock is being "watered," or the public overcharged may be disposed of by a little more lucid presentation of financial statements. The political agitator might have to seek elsewhere for subject matter.

The earnings statement of Commonwealth & Southern Corporation for 1930, which is one of the more readable, shows that $141,656,530 came in from all sources. This is what the public paid for service. It cost $54,970,356 to operate the system, and $14,002,056, or 10 per cent, went in the form of taxes —to various government bodies. The use of capital for the year, in the form of bonds and preferred stock, cost a little over 30 per cent of gross revenue, or $42,580,379. Depreciation reserve, a very necessary provision for the replacement of property, took $9,548,369, or 6.7 per cent, and there was a balance of $20,555,368 to reimburse common-stock holders for lending their capital.

The limitations of this twenty million

surplus are seen when it is remembered that the corporation had over 34,000,000 shares of common stock out and the dividend last year was 60 cents a share. It is not difficult to see why the corporation decided to cut to 40 cents early this year. Nor does it seem likely that any sincere critic of the utilities or advocate of government ownership would deem 40 cents a share on stock for which many holders paid over $20 an excessive return.

There is a growing impression that if the essential facts of the average utility's operations were presented, not only to stockholders, but through the press to the public, in simple, straightforward form, many misunderstandings would be prevented and there would be more public appreciation of the difficulties and less tendency to believe the sometimes wild generalizations of the politicians.

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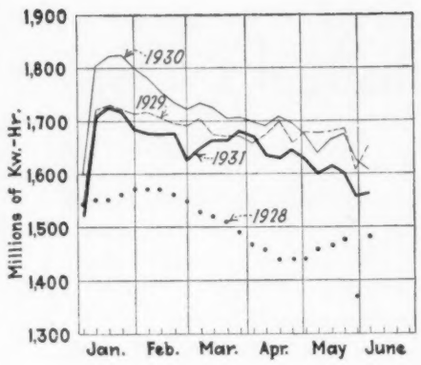
Weekly Energy Output

OUTPUT OF ELECTRIC light and power companies in the United States, as estimated by the statistical research department of the National Electric Light Association, is shown in the accompanying chart. For recent weeks and correspondingly in preceding years the energy generated was:

	Millions of Kw.-Hr.			
Week Ended	1931	1930	1929	1928
May 16	1,614	1,669	1,680	1,470
May 23	1,600	1,673	1,637	1,480
May 30	1,565	1,627	1,606	1,370
June 6	1,562	1,608	1,653	1,480
June 13	1,581	1,663	1,675	1,480

Operations are gradually drawing closer to those of 1930, but are down



compared with 1929; it was during the spring of that year that industrial activity reached its zenith.

Output is below last year's mainly because of reductions in the central industrial area, where the figures have generally been more than 7 per cent under those of 1930. In the Eastern states they have quite uniformly been higher, the average increase for the past six or seven weeks being around 3 per cent; on the Pacific coast the fluctuations have been greater, with an occasional low week, but with an average gain of 2 per cent.

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Shrinkage in 1930 Was in Hydro Output

PUBLIC UTILITY PLANTS had an aggregate rating of 34,263,944 kw. at the end of 1930 and an output during the year of 95,936,097,000 kw.-hr., the United States Geological Survey reports in its final statistics for the year. Of the total output 94 per cent was generated in the central stations of electric light and power companies. Further details as to classification appear in Table I. Although plants rated at less than 100 kw. are not included, the effect on the total rating and output of omitting them is negligible.

According to Tables II and III 34.4 per cent of the output came from water power. This is the smallest fraction during the entire period of twelve years covered by the Geological Survey statistics except 1924 and 1925, which had 33.8 and 33.9 per cent respectively. The largest was 39.5 per cent in 1928.

New York leads in total output, 14,403,773,000 kw.-hr. California is second with 8,948,326,000 kw.-hr. In output from water power the leaders are: California, 6,804,162,000 kw.; New York, 5,514,454,000 kw.-hr. Four states have no output from water power: North Dakota, Delaware, Mississippi and Louisiana.

The fuel consumption listed in Table IV is equivalent to 50,654,000 tons of coal. Energy generated from this fuel was 62,514,000,000 kw.-hr. The difference between this and the total output from fuel, in Table II, represents energy generated from wood fuel. The consumption is equivalent to 1.62 lb. of coal per kilowatt-hour. In 1919 it was 3.2 lb.; in 1928, 1.76 lb.; in 1929, 1.69 lb.

Imports from Canada, according to Table III, have been around 1,500,000,000 kw.-hr. annually for the past five years and now are equal to 1.7 per cent of the energy generated by public utility plants in the United States. Exports are negligible.

Table I—Classification of Public Utility Plants, 1930

Type of Plants	Companies	Plants	Capacity (Kw.)	Total Output (Thousand Kw.-Hr.)
Central stations	1,490	3,751	31,976,138	89,951,758
Electric railways	40	54	1,143,310	2,577,485
Steam railroads	6	7	274,560	699,438
Bureau of Reclamation	3	10	32,390	145,053
Public works	9	13	345,780	1,119,018
Manufacturing	61	69	491,766	1,443,345
	1,609	3,904	34,263,944	95,936,097

Table II—Regional Output, 1930

(Millions of Kw.-Hr.)

Division	Water Power	Fuel Power	Total Power
United States	33,021	62,915	95,936
New England	2,137	4,263	6,400
Middle Atlantic	6,190	18,946	25,136
East North Central	2,217	19,947	22,165
West North Central	1,435	4,547	5,982
South Atlantic	5,111	5,784	10,895
East South Central	2,987	895	3,882
West South Central	66	4,989	5,055
Mountain	3,012	687	3,699
Pacific	9,866	2,856	12,723

Table III—Energy Generated, Imported and Exported

(Millions of Kw.-Hr.)

	Output			Imported	Exported
Year	Water Power	Fuel Power	Total	from Canada	to Canada
1919	14,606	24,315	38,921	.....	.....
1920	16,150	27,405	43,555	.....	.....
1921	14,970	26,005	40,975	885	.....
1922	17,207	30,447	47,654	977	.....
1923	19,343	36,322	55,665	1,344	.....
1924	19,969	39,044	59,014	1,302	.....
1925	22,356	43,514	65,870	1,286	.....
1926	26,189	47,602	73,791	1,506	5
1927	29,875	50,330	80,205	1,633	5
1928	34,696	53,154	87,850	1,588	5
1929	34,629	62,723	97,352	1,444	6
1930	33,021	62,915	95,936	1,620	6

Table IV—Fuel Consumption, by Regions, 1930

Division	Coal, Short Tons	Oil, Barrels	Natural Gas, Millions of Cu.Ft.
United States	42,898,067	9,260,051	120,290
New England	2,754,295	1,780,346	0
Middle Atlantic	13,959,521	323,298	87
East North Central	15,593,430	107,419	4,276
West North Central	4,190,904	823,781	13,865
South Atlantic	4,086,922	2,263,692	94
East South Central	824,176	109,770	4,095
West South Central	868,973	1,090,963	70,663
Mountain	611,039	486,332	1,037
Pacific	8,807	2,274,450	26,173

Energy Use Measures Improvement

EVIDENCES of a rise in industrial activity during the past few months are now so definite that hesitation to accept it as an established fact seems no longer justified. The low point was reached in December and January. The subsequent improvement surpasses in magnitude the corresponding change in 1929, when industry was climbing to its peak, and is in marked contrast to 1930, when the trend was downward.

Returns for electrical energy consumption, a significant indicator of production, covering some 3,800 mills and factories as received monthly by the ELECTRICAL WORLD, result in an index for May of this year 13 per cent above that for January; in 1929 it was only 3 per cent above; in 1930 2 per cent below. It stands only 8 per cent lower than it stood a year ago; it remains 19 per cent below the figure for May, 1929, when manufacturing activity was at its height. As the upper chart shows, owing to the contrary slope of this year's curve compared with last year's, the two are closer together than at any time since 1929.

Diverse currents mark the progress of the several industries. Broadly, it appears that industries having to do with food and clothing are making the best progress. The statement is general; of course, there are exceptions; moreover, individual plants often depart widely from the average.

Manufacture of food products, for example, has moved so much upward from its December level that it now surpasses the status at this time in 1929. The peak came in 1930. Similarly, leather has climed 30 per cent since last winter, but averages lower than in 1930 except for an erratic drop in May of that year. The textile index is the best in more than a year.

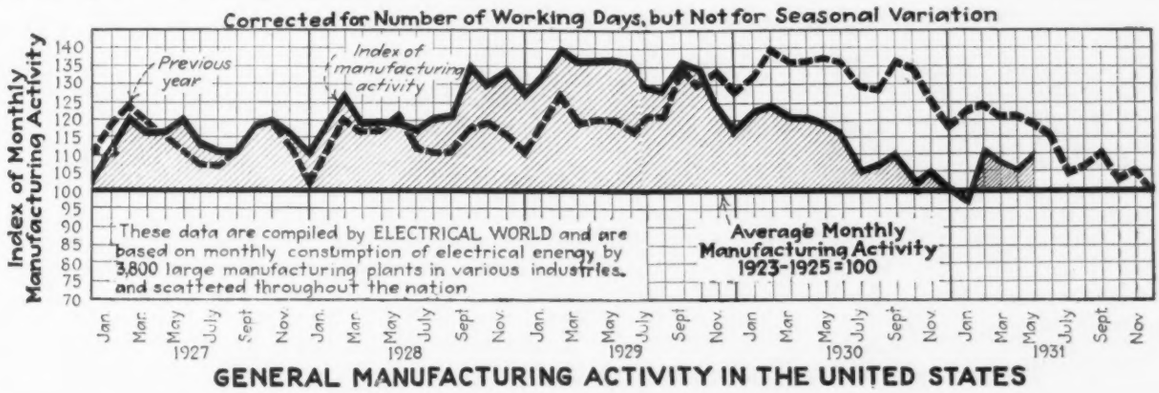
Lumber, rubber and the stone group also show gains, but iron and steel, metal working and chemicals dropped, while in automobile manufacture, nearly steady since February, the five-month average is 20 per cent below 1930.

Index of Manufacturing Activity

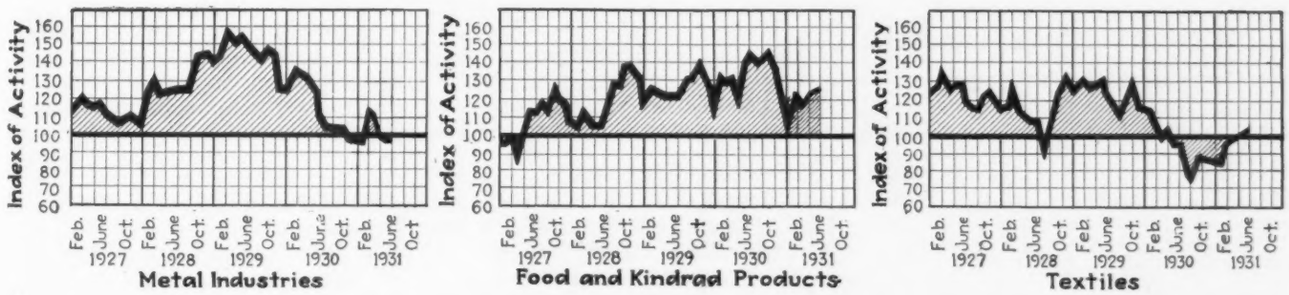
Base: Average Month 1923-25

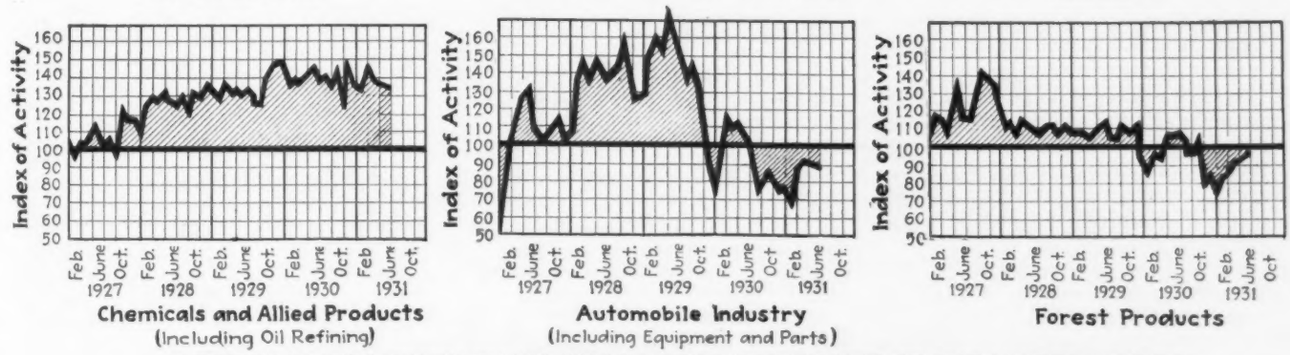
Industrial Group	May, 1931	April, 1931	March, 1931	Feb., 1931	May 1930
All industry	109.8	106.4*	108.2	110.3	119.0
Automobiles (incl. parts and accessories)	89.7	90.8	94.1	88.9	106.5
Chemical products (incl. oil refining)	133.8	137.4	139.3	146.6	146.6
Food products	126.8	122.0	116.8	122.0	138.2
Iron and steel	106.6	108.1	119.4	116.5	135.1
Metal working	94.0	94.6	103.5	112.3	116.3
Leather products	81.0	83.9	71.2	76.1	66.3
Forest products	97.2	91.5	93.2	84.2	102.4
Paper and pulp	135.1	109.6*	123.0	127.0	132.2
Rubber products	122.3	109.0	109.6	112.9	135.3
Shipbuilding	89.7	92.5	98.3	114.8	113.2
Stone, clay and glass	132.0	116.5	105.1	102.6	121.2
Textiles	103.7	100.0*	97.3	99.3	96.0

*Revisions.


Corrected for Number of Working Days, but Not for Seasonal Variation
Index of Monthly Manufacturing Activity
Previous year
Index of manufacturing activity
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries, and scattered throughout the nation
Average Monthly Manufacturing Activity 1923-1925 = 100
1927
1928
1929
1930
1931

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES





ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Markets

Wholesaler Sales Down 23 per Cent

ELECTRICAL WHOLESALER SALES for 1930 dropped 23.26 per cent, from $589,497,000 in 1929 to $452,349,000, according to figures just issued by the *Jobber's Salesman*. Range sales are not included in these totals.

A sharp advance was made in refrigerator sales. Coming into the picture in 1926 with total sales of $2,947,000, refrigerators reached $17,584,545 last year.

Power motors and motor control equipment declined only slightly, from $16,285,000 to $15,647,346. Transformers, insulators and other central-station distribution equipment dropped by about the same margin, from $15,583,000 to $14,294,550.

Several groups, on the other hand, showed substantial gains from 1929 to 1930. Fractional-horsepower motors doubled, from $3,085,000 to $6,253,401. Measuring and testing instruments rose from $2,008,000 to $5,292,608. Storage batteries jumped sharply, from $579,000 to $5,069,867, and flatirons increased from $5,469,000 to $6,084,791. Incandescent lamps rose slightly, from $54,069,000 to $54,707,448.

Totals for the past six years follow:

1925....	$531,000,000	1928....	$610,000,000
1926....	629,200,000	1929....	589,497,000
1927....	675,661,000	1930....	452,349,000

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Weston Electrical Instrument Buys Jewell Company

ANNOUNCEMENT IS MADE by the Weston Electrical Instrument Corporation that it has acquired the business and assets, subject to the liabilities, of Jewell Electrical Instrument Company of Chicago. The Jewell Electrical Instrument Company was organized in 1903 and has been prominent in the small instrument field for many years, particularly in the manufacture of instruments useful in the radio art.

The acquisition, it is understood, will give greater range to the products and service of the Weston company, will afford it additional distributing facilities, especially in the Middle Western field, and lead to further expansion in research and development.

The Jewell activities will be conducted by a newly organized subsidiary company, to be known as Jewell Electrical Instrument Company, which will continue manufacture at the Chicago plant under the old management and without substantial changes in the personnel and sales representatives. Orval Simpson has become chairman of the board of directors and Ray R. Simpson president of the new company.

In connection with the acquisition the Weston company has issued 14,000 additional shares of its common stock in part payment.

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Garrard Is Awarded Longstreth Medal

THE EDWARD LONGSTRETH MEDAL has been awarded to Charles George Garrard of Thorn, Dunstable, Bedfordshire, England, for his invention of a speed reducer, by the Franklin Institute, Philadelphia. The Garrard speed changer is of the adhesion type with hardened steel rollers rolling in contact with one another in a bath of oil, producing a unit of extremely high efficiency which, owing to the absence of wear, is maintained throughout a long life. The Crocker-Wheeler Electric Manufacturing Company builds it in this country, and has developed it in sizes up to 180 hp., and large numbers are now in succesful use in such widely different fields as steel mills, on submarines, in pharmaceutical plants, etc., while a very large field is open for its use in connection with conveyors, blowers and fans.

Convincing evidence of the reliability of this speed changer is its recent standardization by the Royal National Lifeboat Institution for Great Britain.

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Trade Practice Code Method Unsatisfactory

THE trade practice code method of regulating industry under the ægis of the Federal Trade Commission has not worked out in many branches of industry. Certain industries have decided to abandon all attempts to obtain satisfactory code revisions and are ready to rely, rather, upon the Department of Justice for relief from unfair competition. While no action in the matter has yet been taken by the various branches of the electrical industry, a number of separate sections in this group are now studying the problem to determine what course of action should be taken.

The decision of the group of industries referred to above follows the return last week of 80 codes which the commission had extensively revised in a way which the industries believe makes them useless except as a restatement of existing laws affecting business.

A group of trade association executives and attorneys met in Washington last week and adopted a resolution deploring the action of the commission in adhering to the extreme revisions of codes. They recommended that the Congress of Industries discontinue its efforts to get favorable consideration from the commission. It advised the congress to recommend that individual industries continue their efforts to elevate business standards with or without the co-operation of the commission at the option of each industry.

Special criticism was voiced at certain revisions which deleted rules covering practices that have long been recognized by the courts. The commission refused to recognize the use of a base price list, for example. Quotation of prices as so much "off list" has long been a customary practice upheld in the courts and accepted by the Department of Justice. The commission struck out rules which, in specific terms, purposed to prevent price discrimination as defined in the Clayton act. One such deleted rule condemned any departure from terms and discounts that would result in discrimination between customers of the same class or who buy in the same quantities. In another deletion the commission apparently denied that there is any discrimination in the sale to some customers of less than carload lots of merchandise at carload prices.

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General Electric Adds Million-Dollar Unit

PUBLIC INSPECTION of a new million-dollar arc-welded transformer tank shop was held June 6 at the Pittsfield plant of the General Electric Company. The occasion marked the completion of the latest unit in the company's manufacturing facilities. It will be devoted

solely to the manufacture of large electrically welded steel tanks for transformers and the complete operation from the flat steel to the finished painted tank will be carried on under one roof.

The building, which is 550 ft. long and 150 ft. wide, is built entirely of steel members. More than 1,500 tons of structural steel united with more than 5,000 linear feet of electrical welds form the framework of the building.

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TRADE BRIEFS

Directors of Sylvania Products Company and Nilco Lamp Works, Inc., Emporium, Pa., have decided upon a merger.

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Kahle Engineering Company has opened offices and a warehouse at 548 39th Street, Union City, N. J., to do business in machinery, equipment and raw materials used in the manufacture of radio tubes, incandescent lamps, neon lamps and other vacuum products.

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Max H. Romig has been appointed assistant advertising manager of Leonard Refrigerator Company.

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The 1931 edition of "Rare Metals" has just been published by the Fansteel Products Company, Inc., North Chicago, Ill.

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For the three months ended April 30, Servel, Inc., reports net profit of $448,253, equal, after preferred dividends, to 25 cents a common share, against a net loss of $45,199 in the preceding three months.

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Diamond Electrical Manufacturing Company, Ltd., of Los Angeles, affiliated with the Square D Company, Detroit, recently opened a new branch factory of the Diamond Division at San Francisco.

Holophane Issues Lighting Publication

A NEW PUBLICATION, under the caption "Lighting Specifics for Generating and Substations," was issued recently by the engineering department of the Holophane Company. It is especially for engineers who design generating stations and substations and discusses in considerable detail the most suitable type of lighting in the various plant locations. It outlines the requirements and the equipment suggested and illustrates some representative installations.

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New York Metal Prices

	June 10, 1931 Cents per Pound	June 17, 1931 Cents per Pound
Copper, electrolytic	8¼	8
Lead, Am. S. & R. price	3.75	3.75
Antimony	6.20	6.05
Nickel, ingot	35	35
Zinc, spot	3.65	3.65
Tin, Straits	23.10	22.0
Aluminum, 99 per cent.	23.30	23.30

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EXPORTS OF ELECTRICAL EQUIPMENT (PRELIMINARY)

Article	April 1930	April 1931
Generators:		
Direct Current—		
Under 500 kw.	41,884	23,408
500 kw. and over	39,384	10,000
Alternating Current—		
Under 2,000 kva.	43,979	5,634
2,000 kva. and over	126,988	.....
Steam turbine generator sets	71,165	748,699
Accessories and parts for generators	83,146	40,632
Arc welding sets	48,645	29,738
Self-contained lighting outfits	78,730	33,838
Batteries:		
6-volt storage batteries	164,921	118,004
Other storage batteries	96,259	57,190
No. 6 dry-cell batteries	49,061	43,585
Flashlight batteries	316,338	226,204
Radio B and C batteries (dry)	50,355	38,825
Other dry and wet cell primary batteries	19,954	13,588
Transforming or converting apparatus, Power transformers, 500 kva. and over	208,093	53,372
Distribution transformers, less than 500 kva.	187,099	75,322
Instrument transformers	18,060	8,382
Other transformers	84,395	34,389
Complete battery chargers under 15 amp.	11,311	5,823
Double-current and motor generators, dynamotors, synchronous, and other converters	92,303	119,383
Transmission and distribution apparatus:		
Switchboard panels, except telephone	176,309	76,775
Power switches and circuit breakers over 10 amp.	169,634	93,677
Fuses	30,205	14,401
Watt-hour and other measuring meters	54,942	93,651
Electrical indicating instruments	75,064	52,754
Electrical recording instruments	30,431	26,570
Other electrical testing apparatus	78,308	39,859
Lightning arresters, choke coils, reactors, and parts	103,061	58,993
Motors, starters, and controllers:		
Motors, ¼ hp. and under	197,502	216,120
Motors, over .. and under ¼ hp.	49,050	42,593
Motors, starters and controllers (con.):		
Stationary Motors—		
1 to 200 hp.	303,387	185,225
Over 200 hp.	60,041	15,578
Railway motors	28,475	800
Electric locomotives—		
Railway	16,660	.....
Mining and industrial	55,861	95,775
Station and warehouse electric motor trucks	18,324	9,643
Starting and controlling equipment—		
For industrial motors	133,643	147,774
For electric railway and vehicle motors	11,538	3,028
Portable electric tools	90,420	85,064
Accessories and parts for motors	208,069	139,095
Electric refrigerators and parts:		
Household	1,240,459	1,165,547
Commercial up to 1 ton	255,685	283,622
Parts for electric refrigerators	.....	371,398
Electric appliances;		
Electric fans	158,943	54,460
Electromechanical health exercisers	18,834	2,772
	18,834	2,772
Electric incandescent light bulbs—		
For automobiles, flashlights, and Christmas trees	17,901	12,944
Other metal filament	109,583	57,890
Other electric lamp bulbs	39,009	9,620
Flashlight cases	142,749	49,421
Searchlights and floodlights	55,538	68,526
Electric household washing machines	163,650	116,034
Electric domestic vacuum cleaners	204,818	138,052
Other domestic motor-driven devices, except tools	101,088	49,836
Electric flatirons	21,033	25,731
Electric cooking ranges	21,569	34,913
Other domestic heating and cooking devices	86,095	66,536
Industrial electric furnaces, ovens, and other heating devices	59,372	77,221
Therapeutic and x-ray apparatus	142,307	108,750
Signal and communication devices:		
Radio apparatus—		
Transmitting sets, tubes and parts	147,384	37,398
Receiving sets	649,294	1,093,430
Signal and communication devices (con.):		
Receiving-set components	217,686	260,065
Loudspeakers	133,704	94,162
Other receiving-set accessories	116,736	44,175
Telegraph apparatus	53,727	25,729
Telephone apparatus—		
Telephone instruments	44,874	57,909
Telephone switch boards	39,194	11,632
Other telephone equipment	380,082	173,649
Bells, buzzers, annunciators, and alarms	35,141	24,428
Other electric apparatus:		
Spark plugs	105,582	110,561
Other starting, lighting, and ignition equipment	174,307	82,447
Insulating material	95,110	65,294
Metal conduit, outlet, and switch boxes	109,833	67,851
Sockets, outlets, fuse blocks, and lighting switches	153,217	138,837
Electric interior lighting fixtures	170,632	120,472
Electric street lighting fixtures	25,470	28,495
Other wiring supplies and line material	122,154	78,383
Other electrical apparatus, n.e.s.	742,337	378,394
Rubber and friction tape	39,176	24,774
Globes and shades for lighting fixtures	50,654	37,177
Glass electric insulators	30,683	5,619
Electrical porcelain;		
For less than 6,600 volts	56,757	17,732
For 6,600 volts and over	125,923	170,311
Carbons and electrodes:		
Electrodes for electric furnaces	144,946	141,105
Other carbon products	65,456	44,117
Insulated iron or steel wire and cable	21,333	7,841
Copper, bare wire	280,828	287,489
Insulated copper wire and cable:		
Rubber-covered wire	87,131	32,303
Weatherproof wire	14,321	27,436
Telephone cable	19,210	9,537
Other insulated copper wire	274,000	208,608
Nickel-chrome electric resistance wire	.....	12,077
Totals	$11,453,970	$9,880,701
Four months ended April 30	$48,628,763	$33,354,692

Market Conditions

SALES of electrical equipment have shown a definite increase on the Pacific Coast this week, although volume has not advanced greatly. Residence building is active. Small machinery sales have definitely increased and there is a greater interest shown by buyers. Street-lighting projects are giving rise to a large number of small orders.

——BUSINESS IN THE EASTERN MARKET is at a low level this week, apparently in advance of a substantial increase in orders now indicated. Government business continues active.

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PACIFIC COAST

—ORGANIZATIONS WHICH HAVE *been trimmed to January conditions are now feeling the pressure of present business, which has increased in the number of transactions if not so greatly in volume. Residence building, for example, is within 15 per cent of last year, whereas industrial construction of the larger size is only 50 per cent as great.*

—MACHINERY MANUFACTURERS REPORT *increased sales of small distribution transformers, though still below usual June standards.*

Interesting orders include a $7,500 sale of Westinghouse synchronous condensers to the Northwest, a carload of ranges to a Seattle jobber, $12,000 worth of network protectors and a.c. transformers for the Oakland district, $28,000 worth of motors and distribution transformers for the Hoover dam, three General Electric induction regulators valued at $12,000 for Santa Maria and three 333-kva. General Electric transformers for Coalinga. Industrial sales are featured by shipments of machinery and supplies to several oil fields and mines, though raw material conditions in those lines are still poor.

Government business includes a prospective $100,000 electrical contract for the Hawaiian Islands, a $45,000 contract covering Diesel engines and automatic generator equipment for Alaska and a $1,000,000 Phoenix office building, in all of which California bidders will figure. About $100,000 worth of state and municipal lamp business is to be placed within the next few weeks. Other interesting business includes an $18,000 electrical contract for Pomona, a $1,500,000 program for California state hospitals, a $1,000,000 combined store and display building for Oakland and a $1,000,000 glass factory for Alameda, an $800,000 health center for San Francisco, a $500,000 technical educational building for Pasadena, and increasing activity in street-lighting projects, which have been very quiet. Contractors are now figuring on the monumental Golden Gate bridge, with a 50 per cent longer span and a 100 ft. higher tower than any previous suspension bridge. Lighting is to feature this bridge.

Largest single order for motors was placed last week by the Northwest Chair Company of Tacoma, which plant is changing from line shaft to individual drive. The sale involves 38 machines from 15 hp. down. Movement of motors reported including 50 machines from 60 hp. down to woodworking plants, dealers and small industrials, twelve to mines from 50 hp. down, 40 to miscellaneous sources, including a few to lumber mills, and 35 from 100 hp. down to pulp and paper mills, canneries and for agricultural uses.

Ninety electric ranges were sold to the Seattle lighting department for $9,426. An award for the installation of a lighting system at the state Capitol at Olympia went to the Martin Hardware Company of Olympia for approximately $15,000. Puget Sound Power & Light Company plans immediate reconstruction of Index power plant and extension work in Snohomish county costing about $15,000. Electric refrigerator sales are reported 25 per cent or more greater than last year.

CONSTRUCTION PROJECTS

Southern California Edison Company, Los Angeles, Calif., plans extensions in power substation in Beverly Hills district, estimated to cost $150,000. Signal Office, Ninth Corps Area, San Francisco, Calif., will receive bids until June 29 for underground and aerial cable, laterals, terminals, etc. (Circular 7). City Council, Beverly Hills, Calif., will receive bids until June 30 for 70,000 ft. lead-covered wire for Lighting District No. 1. Acme Motor Company, Vallejo, Calif., plans service, repair and garage building to cost about $75,000. Oakland Laundry Company, Oakland, Calif., has plans for a plant to cost over $200,000. National Park Service, Underwood Building, San Francisco, Calif., has an appropriation of $68,000 for a power plant in Rainier National Forest Park, Wash.

SOUTHWEST

—ACTIVITY IS AT A *low level this week. Manufacturers and jobbers interviewed agree that there has been no change in general business conditions previously reported.*

Two or three fair-sized jobs are being figured and some small lots of distribution transformers have been shipped from stock. The only contract reported closed was for an out-of-doors substation with steel framework transformers, switches and lightning arresters for an oil company in Oklahoma, the total amount of the order being $11,000.

CONSTRUCTION PROJECTS

Board of Public Service, St. Louis, Mo., will receive bids until June 30 for a 400-kw. d.c. generator and 200-kw. a.c. generator, with auxiliary power equipment. Kansas Power Company, Salina, Kan., has completed plans for a power plant at Fort Dodge, Iowa, to cost over $150,000. Western Oklahoma Hospital, Supply, Okla., will have plans drawn for a power plant to cost $85,000. Eagle-Picher Mining & Smelting Company, Picher, Okla., contemplates lead mill to cost over $300,000. Joseph Sanger, San Angelo, Tex., is at head of project to construct an oil refining plant to cost over $200,000.

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NEW ENGLAND

—ORDERS FOR ELECTRICAL *equipment eased off during the past week and buying was confined to small lots. industrial equipment sales declined and small motor orders dropped to a lower level in volume. One manufacturer reports little interest in heavy machinery and inquiries are confined to small turbo-generator units, a number of which for institutions will be placed in the near future.*

General scheduled material orders were less active during the past week. Central-station equipment is in less demand due to cancellation of a number of projects involving service extensions. On the other hand, spotty trends are noted in pole and wire orders and buying of wiring materials is uneven, though school contracts in good number are soon to be awarded. New construction includes a new picture theater costing $2,000,000, service extensions for a telephone company amounting to about $2,966,930 and a new service garage and station for the Boston Consolidated Gas Company and a new service shop for Boston Airport.

CONSTRUCTION PROJECTS

State Hospital, Palmer, Mass., contemplates an equipment storage and distributing plant to cost $70,000. Bureau of Yards and Docks, Navy Department, Washington,

D. C., will receive bids until June 24 for an addition to hangar and shop at aviation base, Squantum, Mass. (Specification 6516). Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until June 23 for one electric test bench for Boston, Mass., navy yard (Schedule 5902).

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EASTERN

—WITH CONDITIONS NORMAL, *the present status of the electrical equipment market at New York would be considered as a premature decline into summer lethargy; as it is, the situation is one to be taken as another lull before a round of orders, for it would be difficult to find a market more erratic in buying characteristics from week to week.*

—A SIZABLE CENTRAL-STATION *order for an important transmission line is a bright spot in immediate business from that quarter, while electric locomotives for industrial service show a rather encouraging trend in that field. Government account continues to interest a large group of manufacturers, despite reduced levels for equipment of all kinds. Floodlighting apparatus for airports and municipal fields carries a stronger tone than for some weeks.*

General Electric Company will furnish equipment for the new joint transmission line of the New York Edison Company and Niagara Hudson Power Corporation in Westchester County and north, and has secured commitments for three 30,000-kva. and one 15,000-kva. synchronous condensers for use at the Hell Gate station of the first noted utility company, six large auto-transformers for a new power substation to be located near Poughkeepsie, and for a 15,000-kva. bank of transformers and accessories for a proposed substation at North Troy. The transmission line will operate at 132,000 volts and is scheduled for completion in the fall. General Cable Company is expected to secure an award on bid recently made for furnishing a quantity of lead-covered cable for the city of Los Angeles.

Mid-West Locomotive Company is the succesful bidder for two gas-electric locomotives for the Albany Port District Commission, Albany, N. Y. Westinghouse Electric & Manufacturing Company will furnish all electrical equipment for two 18-ton, 225-hp. electric locomotives for the Sterling Coal Company, including pneumatic control, air-brake apparatus and auxiliary equipment, the order said to total $24,000. Westinghouse is understood to be placing orders with industrial interests for materials in connection with recent contract for electric locomotives for Pennsylvania Railroad Company and will make substantial purchases of copper, sheet steel, aluminum, rolled steel for frames, steel shaftings, forgings for cut gears, mica, etc.

CONSTRUCTION PROJECTS

Stumpp & Walter Company, New York, has filed plans for a multi-story storage and distributing plant for its seed business, estimated to cost $175,000. Sinclair Refining Company, New York, plans extensions and improvements in oil refinery at Fort Worth, Tex., to cost over $1,400,000. Darling & Company, Chicago, Ill., plan extensions in fertilizer plant at Buffalo, N. Y., reported to cost over $65,000. Signal Supply Officer, United States Signal Corps, Army Base, Brooklyn, N. Y., will receive bids until June 24 for fuses rheostats, plugs and other supplies (Circular 196); also, at same time, for 760,000 ft. of wire (Circular 195); at same time, for armature assemblies and magnetos (Circular 197); until June 26 for rheostats, resistors, relays and other supplies (Circular 204). Public Service Electric & Gas Company, Newark, N. J., plans steel tower transmission line from Burlington to Trenton, N. J., to operate at 132,000 volts. Department of Public Welfare, Philadelphia, Pa., has approved plans for a cell building and mechanical shop at institution at Holmesburg, Pa., to cost $259,990.

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SOUTHEAST

—WHILE CENTRAL STATIONS *continue to mark time, industrials show a bit more activity, though as yet this activity is reflected principally in the increase in small orders and in the number of inquiries. One of the larger power companies in the past two weeks ordered $11,700 worth of distribution and small power transformers and $6,350 worth of creosoted pine poles.*

Meter orders last week totaled $6,800. A power company on the west coast of Florida ordered 40,000 lb. of bare and weatherproof copper wire, while a Tennessee company ordered a switch house costing $5,000. Two mills in north Georgia are revamping their lighting arrangements and last week ordered a total of $9,000 worth of lighting equipment, while another mill in the same section purchased $5,000 worth of motor equipment. Some interesting prospective business includes $50,000 worth of motors, transformers, switchboard, feeder regulators, etc., for a new north Georgia plant, $20,000 in motors and crusher machinery for a Florida plant and wiring materials approximating $10,000 for a Georgia plant that is changing the plant layout. These three orders should be placed within the next couple of weeks. Municipal and county owned plants were responsible for several orders last week, a Tennessee town ordering 17,000 lb. of bare and weatherproof copper wire, while a county plant in Georgia ordered similar material totaling 10,000 lb. A Georgia town ordered switchboard equipment costing $2,500 and construction materials amounting to $6,000 are to be ordered this week by another town in the same state.

CONSTRUCTION PROJECTS

Virginia School Supply Company, Richmond, Va., plans improvements in plant to cost over $75,000. American Peanut Corporation, Norfolk, Va., contemplates alterations and improvements to cost more than $250,000. Harker Pottery Company, East Liverpool, Ohio, has approved plans for extensions in plant at Chester, W. Va., to cost $150,000. Carolina China Clay Company, Penland, N. C., plans clay-mining plant to cost approximately $80,000.

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MIDDLE WEST

—SLIGHT IMPROVEMENT *in general business observed the first week in June in the Middle West section appears to be carrying over this week. The volume of business is increasing gradually and a better feeling is being manifested generally.*

—SOME ENCOURAGING REPORTS *from the various railroads, such as the re-employment of 700 workers and the purchase of 500 new box cars, are particularly welcome at this time.*

The major industries continue to maintain their positions, with some large contracts for steel being placed in the Chicago district. The production of electrical energy remains constant and the whole business aspect appears to be taking on a more decided upward trend.

Some of the interesting orders placed this week include construction of a 66-kv. high-tension transmission terminal, structural steel for a 12-kv. distribution station valued at $65,000, erection of structural steel for a 12-kv. distribution terminal to cost $20,000, construction of an underground conduit line, $35,000; one 57-cell operating bus battery, 300 10-amp. maximum demand meters and 65 Thompson meters, 5 to 25 amp. capacity.

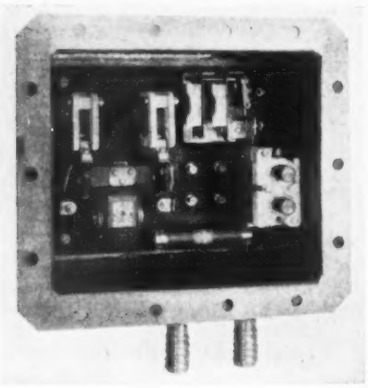
CONSTRUCTION PROJECTS

Lake Mills, Wis., has secured permission from the state to build an addition to power plant and install additional equipment. Edward Katzinger Company, Chicago, Ill., has filed plans for an addition to tinware plant to cost about $150,000. Ozarka, Inc., Chicago, Ill., will establish new radio equipment manufacturing plant to cost over $75,000. Streator Clay Company, Streator, Ill., plans extensions and improvements in clay tile plant to cost about $100,000. Lighting Commission, Detroit, Mich., has plans under way for a power substation to cost about $50,000. Norge Company, Detroit, Mich., contemplates expansion program at electric refrigerator plant to double capacity. Olivet College, Olivet, Mich., plans power plant to cost about $40,000.

New Equipment Available

Magnetic Starter Has Thermal Overload Relay

AN EXPLOSION - TESTED MAGNETIC STARTER recently developed for line starting 1 to 5-hp., 230 and 550-volt motors on applications requiring the U. S. Bureau of Mines approval as permissible equipment has been placed on the market by the Westinghouse Electric & Manufacturing Company. Inverse time limit overload protection is supplied by a thermal overload relay with characteristics which permit the



short high-current peaks caused by line starting and still are accurate and sensitive to any overloads of long duration. The time-saving feature of automatic reset is supplied on this relay.

Fused short-circuit protection is obtained by a fuse connected in the positive lead and low-voltage protection which prevents unexpected or unsupervised starting is provided on these line starters. The start and stop push-button unit is mounted in the case and operated by plungers from the front. The electrical circuit is broken by a two-pole magnetic contactor which has an arc-rupturing capacity of 150 amp. at 500 to 550 volts when totally inclosed in a permissible compartment.

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2,500-Volt Portable Current Transformer

A PORTABLE CURRENT TRANSFORMER for general-purpose testing has been announced by the General Electric Company. Designated as type PR-1, the transformer measures $3\frac{5}{8}$ x $9\frac{1}{4}$ in., with a height over terminals of $9\frac{7}{8}$ in. Weighing only 13 lb., the transformer is provided with a convenient carrying case and is easily handled.

This multi - range transformer has ratings up to 1,100 amp. in a series of eleven steps. The secondary rating is 5 amp. The transformer is suitable for use on 2,500-volt, 25 to 125-cycle circuits.

The metal case is crystalline lacquered and the cover is of black "Texolite." The core and windings are firmly attached to the cover, which is easily removed for inspection.

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Duplex Flush Receptacle

A TOP-WIRED BROWN bakelite duplex flush receptacle complete with brown bakelite plate having integral bosses has been announced by the Bryant Electric Company, Bridgeport, Conn. The top wiring terminals of this receptacle have two binding screws in each side, making of the device a connecting block as well as a receptacle. Bakelite shoulders protect the screws and hold the wires in place. The receptacle has a completely inclosed moisture-proof bakelite back. The yoke is of the semi-flexible type, which facilitates easy adjustment in the box without sacrificing the rigidity of the device after installation. The fact that the bosses, which have easy-finding ribs, are integral with the plate does away with imperfectly fitted plates.

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Visual Indication of Interference Intensity

A NEWLY DESIGNED NOISE and interference locater has been announced by the Tobe Interference Laboratories of the Tobe Deutschmann Corporation, Canton, Mass. The circuit consists of four especially designed stages of RF and two of audio, using three shielded grid, type 232 tubes and three type 230 tubes for detector and audio stages. The output circuit of the audio amplifier includes a transformer feeding an intensity meter through a copper oxide rectifier. This meter provides a visual indication of interference intensity, an accurate determination of interference or noise level.

A filament meter is provided to insure the operation of the tubes at their proper rating, thereby prolonging their life. The chassis is mounted on a special cast aluminum framework and is completely inclosed in a bakelite case.

Air Cleaner Uses Fabric or Fibrous Filter Medium

USING A NEW ADAPTATION of an old principle, an air filtration process has been devised by the Independent Air Filter Company of Chicago. It consists of a series of superimposed hinged wings or panels, into which a continuous sheet of fabric or fibrous filter medium is folded. The development of wood pulp cellulose made possible a compromise between the original cloth strainers and the impingement type, but at first necessitated higher velocities than were consistent with proper cleaning efficiency. The new compact air filter incorporated the principle of low velocity air flow without sacrifice of space or cleaning efficiency. It is equally well adapted to either fabric or fibrous materials and has made possible the use of a new and cheap cotton fabric filter medium that possesses all the advantages of wool felt, yet can be easily and cheaply replaced.

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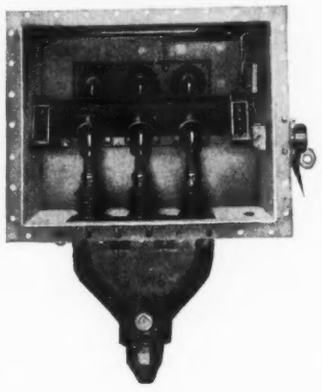
Three-Position Grounding and Disconnecting Oil Switch

A THREE-POSITION grounding and disconnecting oil switch, designated as type GD, has been placed on the market by the G & W Electric Specialty Company, Chicago. Flat contacts are keyed to a standard G & W type TT cable head and the transformer terminals. The links with floating contacts at each end are contained in one-piece porcelain bushings. These bushings are mounted



in impregnated wood strips fastened to a yoke at each end. The shaft is in line with the cable head contacts, about which the yoke is rotated by means of the operating handle. An electrical interlock prevents operation while the circuits are energized. The switch is rated at 15,000 volts, 250 amp.